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**CONTENTS**



*Bob Venosa's painting is intuitive, instinctual, and tactily sensual. The woman's face—Diana, Ishtar, Aphrodite—is an archetypal portrait of Magna Mater, eternal mother, sister goddess. Venosa lives in Spain and has exhibited his work internationally.*

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# FIRST WORD

By Michael O'Donnell

*"Fashions in medicine can be sound, healthy, and productive, but only when the stakes are not too high."*

When I was a young self-satisfied doctor (as opposed to the middle-aged self-satisfied doctor I am today), a snobbish neighbor congratulated me on having established myself as a fashionable doctor. I considered it the most offensive remark he could have made. We medical practitioners, I knew from the full four years of my experience, were as immune to fashion as we were devout in our dedication to science and its methods.

Somewhere between then and now I lost my innocence. Last year when a New York journalist, Janice Hopkins Tanne, described coronary bypass surgery as "the latest fashion for attractive men of a certain age," I didn't bridle, but congratulated her on her perception.

A devil's advocate could argue persuasively that the popularity of bypass surgery derives less from science than from the publicity given to some of the men who have had the operation—people like Arthur Ashe, Alexander Haig and Henry Kissinger. All are rich, successful, powerful, and, above all, active. They invest the operation with a macho quality. Heart disease in middle age is no longer a sign of failure but a battle honor to be worn proudly by thrusting executives.

I'm not suggesting for a moment that coronary bypass surgery is a useless operation. Cardiologists accept that when it is performed on carefully selected patients, it can enhance—even save—their lives. What worries them is whether such surgery was really required by every one of the 110,000 American men who had it last year. Controversy reflected recently in the columns of the *New England Journal of Medicine* suggests that many of those patients have been treated quite needlessly.

Fashions in medicine can be sane or silly, therefore, and the important question is to determine which is which. After Edward VII had had his much-publicized appendectomy, London society flocked to its doctors, eager for the new treatment. No doubt some patients needed it, others with their indeterminate "grumbling" appendixes did not. Surgeons were happy to pander to the fashion, rationalizing their behavior with the self-deceiving phrases that furnished George Bernard Shaw with the most waspish dialogue in *The Doctor's Dilemma*.

In those days there were fashions, too, in medication. These have grown less flamboyant since the thalidomide disaster, yet the laws that governments passed after the thalidomide affair to ensure that drugs were more assiduously tested do not apply to other forms of treatment, new operations or new medical and nursing techniques. These can still be launched with little more to justify them than the enthusiasm of their inventors. In the same way, too, many operations—like the original mutilating operation for breast cancer, the routine removal of children's tonsils and adenoids, and the routine circumcision of newborn boys—were for decades sustained by fashion rather than by objective evidence that they did any good.

The first scientific investigation of treatments for breast cancer began only in the 1950s, and over the next 20 years they revealed the inadequacies of the fashionable surgical treatment. Information from those clinical trials has now defined the role of less radical surgery and of radiotherapy and has raised doctors' hopes of developing successful nonoperative treatment of the disease.

The only antidote to fashion in medicine is the scientific trial. But once a treatment has become fashionable, such a trial is difficult to conduct. Doctors who've seen the treatment apparently helping some patients may think that to deny it to other patients who might benefit, too, would be unfair, even unethical. And patients refused a particular treatment by one doctor will seek out another to provide it.

Doctors who want to do clinical trials also have to breach an emotional barricade. Most clinicians are repelled by the thought of allocating patients randomly to treatments when maybe permanent disability or even life is at stake. They all recognize the role that chance plays in our lives. But even in the face of evidence that guessing in medicine can carry horrific risks, we feel that a well-meaning guess—the treatment *seems* to work—is not as cold as the flip of a coin.

Even the words we use get in the way. A clinical trial is, by its nature, an experiment, and the word *experiment* carries nasty overtones. To maim or kill with well-intentioned guesswork is acceptable because it is not perceived as "human experimentation."

In the 1940s, in a medical tragedy that most people seem to have forgotten, some 12,000 newborn babies were permanently blinded by excessive concentrations of oxygen in their incubators. The cause of the blindness was established only when a group of American pediatricians, in the face of great opposition, conducted a nationwide clinical trial.

One of those pediatricians, William Silverman, still remembers the outrage provoked by the idea of assigning newborn infants to oxygen treatment by lot. He can't help contrasting it with the lack of criticism of the preceding 12 years of fashionable oxygen treatment—he prefers to call it "informal experimentation"—that actually blinded the babies before the truth came out.

Fashions in medicine can be sound, healthy, and productive, but only when the stakes are not too high. ∞

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*Dr. Michael O'Donnell is a writer and broadcaster and a former editor of* World Medicine *magazine.*

# CONTRIBUTORS

# OMNIBUS


ROBINETT


WALLIS


GARR


POWLEDGE


RESTON

We are poised on the threshold of a new era in medical science. By scrutinizing our genes and their protein products, investigators have begun to detect disease susceptibilities. They are in effect beginning to chart our future medical profiles. Heart disease, cancer, and even some mental disorders may someday be diagnosed years in advance of the symptoms. Knowledge of our genetic vulnerabilities might pave the way for startling advances in preventive medicine. However, as contributor *Tabitha M Powledge* cautions, such knowledge will also raise certain moral dilemmas. Powledge served eight years on the staff of the prestigious Hastings Center, a nonprofit organization devoted to the study of the ethical aspects of contemporary life. Her newest book, *The Last Taboo* (Houghton Mifflin), examines the effects of genetic science on the individual and on society. Turn to page 50 for Powledge's probing analysis of the promise—and the perils—of forecasting disease.

How will man look 50 million years hence? That was the challenge *Omni* set before Scottish paleontologist and film animator *Dougal Dixon*. In his highly acclaimed book *After Man*, Dixon portrayed a zoological kingdom of the future in which *Homo sapiens* had become extinct. But what if man had survived and continued to evolve? *Omni* asked Dixon to create such an alternative scenario with the aid of illustrator *Diz Wallis*. "Visions of Man Evolved," their way-out version of our heir-to-come, begins on page 90.

From his first novel, *To Defend, to Destroy*, to his latest book, *Our Father Who Art in Hell*, *James Reston, Jr.*, has established himself as a gifted writer and political journalist. Now in a special *Omni* report Reston turns his attention to the enigmatic and controversial $1-billion John D. MacArthur Foundation, which last year offered the American equivalent of the Nobel Prize. The Prize Fellows Program, a "celebration of creativity," offers grants of up to $300,000 to support scientists, writers, and historians for five years—no strings attached. They can continue their work, change fields, or simply goof off. As a result, the prize seems to have engendered widespread ridicule instead of academic honor. In "Genius Hunting" (page 78), Reston talks to some of the 41 recipients who—in his words—"are as mystified by the awards as the general public is."

Such technologies as cybernetics, psychopharmacology, and brain implantation promise a lot, but will they deliver better living through science or a Brave New Future? *Michel Salomon*, a medical doctor and editor of the French journal *Prospective et Sante*, posed this question to some of the world's top scientists. The resulting dialogue became the basis for a book, *Future Life*, which earned Salomon the 1981 Prize for Humanistic Medicine in his native country. In "Tinkering with Utopia" (page 128), an excerpt from the recent English edition, ethologist Konrad Lorenz, brain-control expert Jose Delgado, and other outstanding intellectuals contemplate man's physiological, psychological, and philosophical evolution in the next millennium.

First came the TV generation. Now the computer generation has come of age. Today's kids learn from computers in school and at summer camp, play with them at home, even steal with them. Science writer *Doug Garr*, coauthor of the upcoming book *The Ultimate Computer*, writes enthusiastically about computer literacy among the young in "Computer Kids," starting on page 74. "The computer is all about mental mobility. It's the automobile of the future," says Garr. "The technology's impact on our children is certain to be staggering."

This month's fiction features the work of *Steve Perry*, a new contributor and author of the popular adventure novel *The Tularemia Gambit*. A former paramedic, Perry put his medical expertise to good use in "Augenblick" (page 60), the story of a dedicated doctor with a remarkable diagnostic talent that presents a morass of professional and personal problems. And *Stephen Robinett* returns to these pages with "Number 13" (page 98), a gripping tale about the first officer of a spaceship who examines his past lives for a solution to his present predicament. ∞

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NOVEMBER

# LETTERS

# COMMUNICATIONS

**Writer Selection**
I have been trying to figure out how you choose the short stories that appear in *Omni*. Many of them are by writers I've never heard of, and I read a *lot* of science fiction. And most of the stories don't have much to do with science.

In the June 1982 issue you have published something by Stanislaw Lem. I should have thought that almost any well-known American science-fiction writer would be honored to do a story for your magazine. So why do you publish such a dull, long-winded, and ultimately pointless story from a man who must be the most boring science-fiction writer in the world—and an avowed Communist as well?

Ralph T. Castle
Salt Lake City, Utah

*Stanislaw Lem is one of the best-known non-English-language science-fiction writers today. Theodore Solotaroff, writing in the* New York Times Book Review, *called Lem "... a major writer, and one of the deep spirits of our age." A Pole living in Cracow, he typically pokes fun at the bureaucracy and stupidity in all ideologies.* —Ed.

Suddenly I find myself buying *Omni*, not just occasionally but month after month. The reason is the top-flight fiction by such authors as Connie Willis [April], Nancy Kress [May], and Howard Waldrop [June].

William Gibson's "Burning Chrome" [July] is the best example of your superb fiction yet. Mr. Gibson's pyrotechnical imagery and emotionally charged characterizations set standards for the field that few can live up to. I want to thank you for giving this story the exposure it so richly deserves.

Lewis Shiner
Austin, Tex.

**Fabulous Photos**
The pictures accompanying "Space Shuttle Album," by Robert Malone [June 1982], were absolutely magnificent. The crystal-clear shot of the cargo bay brought the excitement home to me like nothing I've ever seen. All I can say is: More, more!

Jason Stothard
Evanston, Ill.

**Future Man**
My first reaction to Freeman Dyson's "Future Man" [Antimatter, June 1982] is that the general public will most certainly oppose it. Tampering with man to the extent that Dr. Dyson suggests will frighten and mystify the average person. The forces of orthodox thought and religious belief will accuse him of tampering with the sanctity of life.

This leads me to the question: What good is scientific advancement that will benefit mankind without improving the individual man himself? Only if there is a general uplifting of individual consciousness, will society be ready for Dr. Dyson's work.

Mark Paules
Silver Spring, Md.

**Spiritual Scientist**
Hurray for Brian Josephson [Interview, July 1982]! For a long time I've been waiting to hear of a scientist of his stature who doesn't hide behind his obvious scientific credentials when asked about matters of consciousness and spirituality. You see, you can acknowledge the reality of such things and not cave in to superstition and dogmatism.

Steve Hummel
Polo, Ill.

**Wildlife Entrapment**
I read Irving Lieberman's article "Snakescam" [Continuum, February 1982] with dismay. This "snakescam" operation undertaken by the U.S. Fish and Wildlife Service reportedly uncovered a huge black market in protected and endangered reptiles and led to the biggest bust ever of wildlife smugglers.

This is only half the truth. Investigations have revealed that the Fish and Wildlife Service in fact created a large black market in protected reptiles where formerly only a small illicit trade normally operated. This artificial market was then

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# DIALOGUE

# FORUM

*In which the readers, editors, and correspondents discuss theories and speculation arising out of* Omni. *Readers are encouraged to debate views and pose questions to* Omni, *the scientific community, and the science fiction establishment. The opinions published are not necessarily those of the editors.*

### Soviet Space Wars

While Ben Bova is certainly entitled to use *Omni* for any ax he happens to be grinding, his article "Soviet Space Offensive" [July 1982] was so filled with the frostiest Cold War cliches that I must write a reply.

As a citizen of a minor space power I think that the United States is not as virginal about space warfare as Mr. Bova would like to make out. For instance, let us examine the space shuttle. Many nonpolitical space enthusiasts regard the shuttle as simply a delivery system, a kind of "space truck" that is not, in itself, a weapon. However, ignoring for a moment the suggestion of hawks that the shuttle should be armed, a truck can of course carry anything from flowers to missiles.

It should be noted that the shuttle is a direct descendant of the U.S. Air Force's Dynasoar, which was intended to be a viable space fighter.

Now adding fuel to the fire, the Reagan Administration recently announced a massive funding buildup for an offensive-defensive orbital capability. Not to be outdone, the USSR has begun to test a full-fledged space fighter. While both space superpowers argue about their "peaceful intentions in space," it is clear that they are paving the way for a "Star War" that would make even Darth Vader blench.

Randall Barnhart
Ottawa, Ont., Canada

Ben Bova's article "Soviet Space Offensive" was extremely informative in detailing the space war envisioned by the Soviet Union. The USSR, with justification, fears the high-technology potential that the development of the space shuttle represents as much as it fears any present U.S. military capability.

Post–World War II history has clearly demonstrated to the population of this planet the benefits of living in a free society. An expanded, accelerated industrialization of near space would continue to counter the Soviet propaganda directed against the shuttle.

Dan Marshall
Houston, Tex.

### Noble Sentiments

Ben Bova expresses some noble sentiments in his First Word [June 1982], but I'm afraid he is rather naive when it comes to world politics.

If you will recall, Woodrow Wilson tried to convince the United States and the rest of the world after World War I that a cooperative world political body was needed. American entry into the League of Nations was thwarted by the U.S. Senate. What we have here now is the ineffectual United Nations, which, if current affairs are any indication, may as well not exist.

It is very nice to philosophize about cooperation and lasting world peace, but as I have said, it is also rather naive in the face of the present international political and economic scene.

Lawrence Evans
Chicago, Ill.

### Smart Dinosaurs

I have been following with interest the growing press coverage of Dr. Dale Russell's dinosauroid, and I feel that I should comment on the article "Smart Dinosaurs" [May 1982].

I am puzzled by the direct comparison made between Dr. Russell's specimen of *Stenonychosaurus* and Dr. D. C. Johanson's specimen of *Australopithecus afarensis*, nicknamed Lucy. Jeff Hecht and Gurney Williams claim that "the skeleton Russell unearthed was also about as incomplete as Lucy's remains. Only 10 to 15 percent of the bones were preserved." This is incorrect. Lucy's postcranial skeleton is almost 40 percent complete, while Dr. Russell's *Stenonychosaurus* specimen is at most 10 percent complete.

I believe that the authors were trying to demonstrate a parallel relationship between the ancestry of the dinosauroid in the ostrich-mimic dinosaur *Stenonychosaurus* and the ancestry of *Homo sapiens* in *A. afarensis*.

I feel that this comparison isn't a valid one.

David Galbraith
Guelph, Ont., Canada

Dale Russell replies: *It is true that the skeletal remains of Lucy are more nearly complete than those of the major specimen of* Stenonychosaurus. *Both, perhaps, are far less complete than would be desirable.*

*There was no intention to suggest a parallel between the difference in encephalization in* Stenonychosaurus *and the dinosauroid and in Lucy and modern* Homo sapiens. *Our major objectives were to show how the small dinosaur might be reconstructed from the fragmentary remains, and to provide a logical context for the reconstruction of a hypothetical, highly encephalized descendant. The process is described in more detail in* Syllogeus *No. 37, available from the National Museum of Natural Sciences, Ottawa K1A 0M8, Canada.*

### Maternal Instinct

I was furious to read Pamela Weintraub's article "Mother Love" [Continuum, June 1982]. Ms. Weintraub has obviously never had any children of her own, or she would realize how misinformed and totally absurd Elizabeth Badinter is.

Wherever she got her totally biased data from, it was certainly not from loving mothers. I have been married for 11 years and have four healthy, loved children. I never felt better in my life than while I was pregnant, and every hormone in my body told me to protect my child.

I am sure that there are some women who do not have the maternal instinct, but that does not prove it does not exist.

Donna Sorrentino
New Brunswick, N.J.

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*South Shore Conservatory, Hingham, Mass. Shot with a 48-86 zoom lens at f/5.6 at 1/125 sec.*




*The less you can count on light, the more you need Kodacolor 400 film.*

*America's Storyteller*

# ANIMAL TREMORS

# EARTH

By Douglas Starr

In the winter of 1974 residents of the Chinese province of Liaoning noticed something strange about the animals Snakes crawled out of hibernation and froze, rats fled their burrows in confusion, chickens, horses, and other farm animals began jumping nervously as their incredulous owners looked on The incidents, which had increased over the weeks, reached a freakish crescendo in early February, when the city of Haicheng was hit by a mild series of tremors Alert civil defense officials evacuated the city's half million people —just hours before a massive earthquake leveled the town

The lives saved ushered in a new era of respectability for the use of animals to predict earthquakes In fact, the U S Geological Survey is funding a network of volunteers who will watch animals in an effort to foresee such disasters in California Yet most Western scientists continued to discount the phenomenon, perhaps because they didn't know exactly how it worked

Now comes Helmut Tributsch, a flamboyant but highly regarded German physicist who wants to convince doubters by explaining the mystery His book *When the Snakes Awake*, published for the first time in the United States this November, is perhaps the most compelling argument yet for animal earthquake prediction Tributsch says there's no mystery at all The "precognitive" behavior is merely the way animals react to a pre-earthquake release of ions, or charged particles, from the ground

Tributsch, now a professor at Berlin's Free University, began exploring the phenomenon in 1976, when an earthquake flattened several villages in the Italian Alps, killing 1 000 persons and depriving 100 000 of their homes One of those tiny villages was the professor's boyhood home Returning from research in South America he was not only amazed at the destructive power of earthquakes, but even more so by the stories his old friends and relatives told Hours before the disaster dogs began howling and cows tore at their chains in a frantic effort to get loose "If only we had understood them," an old woman moaned

That cry triggered Tributsch's search for understanding Much like the Greek philosopher-scientists of old, he wandered from village to village, gathering as many anecdotes as he could Delving into Europe's great archives, he found cases of animal precognition over thousands of years Rats, snakes, and weasels, for instance, had fled the Greek city of Helice before it was demolished in the fourth century B C Similar reports persisted through the Middle Ages And the German philosopher Immanuel Kant wrote that birds flew away and mice fled their burrows before the great Lisbon earthquake of 1755 Yet despite hundreds of accounts in Europe and America right through to the twentieth century, the idea of animals as earthquake predictors has been ridiculed or ignored

Not so in China, which, like Western societies, had a rich oral history of animal-earthquake prediction Authorities there—driven by the rural values of Mao's cultural revolution—gave credence to the tales In the mid-1960s China's leaders set up a National Earthquake Prediction Bureau, consisting of a core of seasoned scientists who recorded seismic information, together with more than 100 000 citizen volunteers who reported cases of apparent animal precognition If the animal signs and physical warnings in an area dramatically increased, the bureau would declare an earthquake alert and evacuate all structures Admittedly the program has been plagued with false alarms, but it also has saved at least 100 000 lives in three major earthquakes since it was begun

To explain the phenomenon Tributsch looked for a single signal that could disturb all sorts of animals, whether they spent their time on land, at sea, or in the air At first he asked himself whether vibrations or noise could be the trigger Dogs, for example, get jumpy at sounds we don't hear But noise would not affect animals several hours before tremors began, he knew As for changes in groundwater levels, that could affect burrowing animals, but not those that crawl

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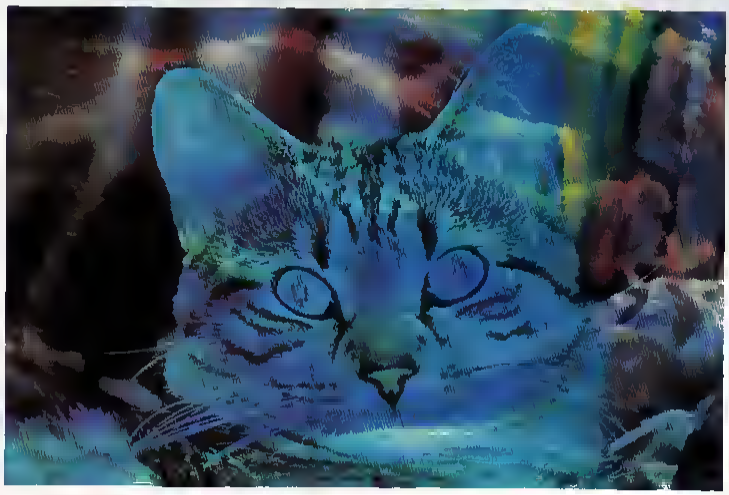

*Positive ions warn animals of upcoming earthquakes hours before the tremors begin*

# THE ICEMAN REVIVETH

# LIFE

By Timothy Perrin

In April 1976, 38 minutes after his car had crashed through the surface of an ice-covered Michigan pond, Brian Cunningham's body was pulled from the submerged wreck. He was pronounced dead at the scene. But as his body was being loaded into an ambulance, he let out an agonized moan, and the race was on to save his life.

By aggressively applying resuscitation for almost 18 hours, Dr. Martin Nemiroff managed to revive Cunningham in what was hailed as a medical miracle. Paradoxically, what saved Cunningham from drowning was another life-threatening condition—hypothermia. This is the severe cooling of the body's core, which kills dozens of people each year. In this particular case, however, the cold lowered the chemical activity and oxygen demand of Cunningham's body, enabling him to survive nearly 40 minutes underwater.

At the University of Victoria, in British Columbia, Dr. John Hayward has been dunking people in ice water and marching them through artificial rainstorms so that he can study the effects of hypothermia. More than 500 volunteers have agreed to journey one third of the way to death—just 6°F from what could be a fatal chill—in the service of science.

"The standard wisdom was that you could survive only three or four minutes in ice water," Hayward says. "I didn't believe it, and I set out to find the truth."

He did. According to his research, most of us could live a half hour to two hours floating in ice-filled waters. "If you're wearing a life preserver," Hayward explains, "that's enough time to do something constructive." His suggestion: Wrap your arms around your chest and cross your legs to reduce heat loss from such critical areas as the groin and the upper torso. And don't move. That's the fastest way to lose heat.

Hayward's hypothermia research is an outgrowth of his interest in hibernation. Small animals have relatively high surface-to-volume ratios and lose much of their body heat to their surroundings. As a result, some must eat their weight in food each day or risk starving to death.

Instead of fighting a losing battle with the environment, many intentionally become hypothermic over the winter or while sleeping. Hibernating squirrels and chipmunks commonly register body temperatures as low as one or two degrees above freezing, permitting them to survive several months on the same amount of food they would normally consume in a day. Sleeping bats cool themselves so much that their hearts beat only four times a minute. During flight, in contrast, the rate soars to 1,200 beats per minute—a 300 to 1 ratio.

The closest thing to human hibernation is what small children experience during delicate brain and heart surgery. By packing infants in ice, surgeons lower their patients' temperatures to less than 70°F, allowing a total shutdown of the circulatory system. But only the very young are taken that low. With adults, surgeons aim for body temperatures near 85°F—still enough to reduce metabolic activity about 60 percent.

Doctors have also begun using a combination of maintained hypothermia and anesthetics in treating coldwater drowning victims. These people frequently suffer from brain swelling, which can cause a fatal build-up of pressure inside the skull. According to anesthetist Dr. John Green, of the Royal Jubilee Hospital, in Victoria, such patients should be given barbiturates and their already-numb bodies should be cooled even further. "We just knock them out as we would for surgery and keep them in that state for three to five days," he points out. "Clinically they're very close to death." The coldness slows the brain's chemical processes while the drugs halt all electrical activity. The brain needs less oxygen, and so blood flow to the head is reduced. This, in turn, helps to relieve the pressure inside the cranium.

Hayward thinks this is as close to human hibernation as we're likely to get for at least another century. "You can preserve some tissues up to a few days by chilling," he says, "but put them all together—especially brains and hearts—and suspended animation is beyond our wildest dreams at present."

*Stranded skiers are frequent victims of hypothermia, the fatal cooling of the body's core*

# SPACE

By Owen Davies

For years now enthusiasts have trumpeted the practical benefits of space. If only we could go there regularly, they have claimed, we could discover an entire universe of opportunity for industrial applications in the zero-gravity environment. Economist Klaus Heiss, president of Princeton New Jersey's Space Transportation Company (STC), is so convinced of it that he wants to buy a shuttle orbiter and set up shop as a private launch service. Proof that his chosen market is more than a fantasy has been hard to come by.

But that proof arrived when *Columbia* returned from space a fourth time. On board was a sophisticated chemical-processing experiment flown by scientists from McDonnell Douglas and Ortho Pharmaceutical. Using a process known as electrophoresis, the equipment is designed to purify drugs and other complex compounds. If it could be made practical, electrophoresis would improve the quality of interferon, hormones, and similar natural products while cutting costs. Such purifications offer a $1-billion market for any entrepreneur who can carry them out.

On Earth, gravity tends to remix the desired product with the impurities even as the equipment is trying to separate them. Electrophoresis can still produce very pure drugs, but only in very small quantities. The larger the machine on Earth and the more material you put into it, the less efficient is the process and the more contaminated is the product that comes out. So McDonnell Douglas researchers decided to do away with gravity, packed the separation device into a narrow, rectangular box six feet long, and mounted it on a wall of the space shuttle's cabin.

"We knew the machine had worked properly almost as soon as we got it back," says Jim Rose, program manager for McDonnell Douglas. But how well it worked is only now becoming clear. "The purification was just as effective as on Earth," Rose adds, "but we were able to put four hundred times as much material through the machine." At that level of output, electrophoresis becomes a practical manufacturing process.

Sometime in 1985 the researchers plan to launch a larger and more ambitious electrophoresis package, about 14 feet in diameter and 4 feet long. If that device works well, the developers will be in a good position to begin selling products from space by 1987.

If McDonnell Douglas has reason to be pleased with its success, Heiss may have even greater cause for celebration. Proof that earthly profits can be earned in space is one of the things he needs most to make his proposed shuttle-launch service work.

It is an audacious scheme. Backed by the large investment-banking firm of William Sword and Company, Heiss proposes to pay for a fifth orbiter, called for in the original plans for the shuttle program but so far not funded by Congress. By early next year the company would put up a down payment of $200 million to $300 million, the first installment of a $1-billion investment.

In return, Heiss's company would receive exclusive rights to market the launch service to domestic and foreign commercial clients. STC's prices would be the same ones charged by NASA for previous orbiters. But Heiss says that aggressive salesmanship by a private company, with big money at stake, would make the project profitable—far more so than operation by a government agency that has never had to hustle for a buck outside the netherworld of Washington, D.C.

And STC might have greater crops to harvest. One obstacle to a thriving space commerce has been that business firms cannot count on having their space hardware get into orbit on time; military payloads can bump them off the shuttle with little notice. Such an unpredictable delay can cost millions of dollars. According to Heiss's plan, STC flights would be exempt from bumping except in a dire national emergency. "The recent British decision to requisition the *Queen Elizabeth 2* is a good example," he notes.

NASA would handle the actual launches, operating the fifth orbiter as

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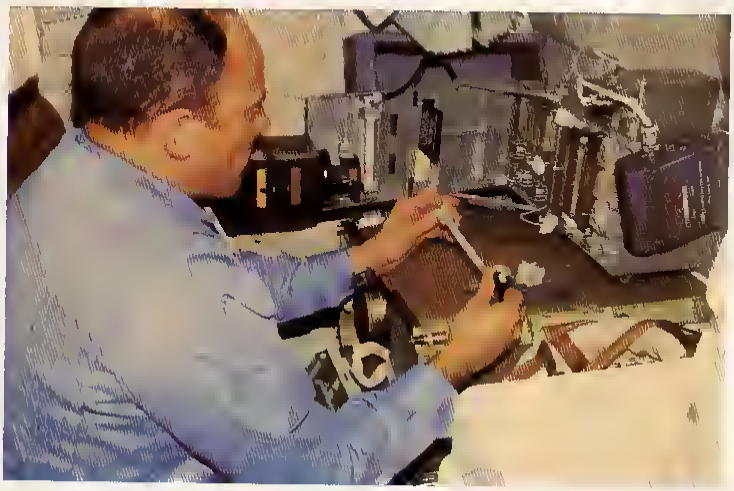

*Astronaut Jack Lousma prepares an electrophoresis experiment aboard the shuttle*

# PSI-Q I REPORT

# MIND

By Stephan A. Schwartz and Rand De Mattei

What gives you psychic powers? Is it something to do with which side of the brain you use more often? For that matter, do psychic powers really exist?

A little over a year ago, in *Omni*'s October 1981 issue, our readers took Psi-Q I, a test in precognition designed by the Mobius Group, a research team that specializes in the practical use of paranormal abilities. (This test is not to be confused with Psi-Q II, which was presented last month to test *Omni* readers' abilities in remote viewing.) Fully 18,000 readers responded to Psi-Q I, of whom 15,470 completed the questionnaire. It was this group whose answers we analyzed.

The results are now in, and while Psi-Q I did not prove that *Omni* readers can foretell future events, it hinted strongly at the mental traits that contribute to paranormal abilities. And it revealed a lot about the readers themselves.

The test was in two parts: a detailed questionnaire designed to reveal the subject's personality, thinking habits, creativity, and brain-hemisphere dominance (which half of the brain is more active), and a blank clock face. Subjects answered the questions, then tried to foretell which five positions on the clock face would be chosen by a random-number generator long after the questionnaires had been handed in.

The idea was to confirm the existence of precognition, then find out what mental characteristics contribute to it. We were only partially successful, but even that partial success was striking and informative.

In a test population as large as ours, you'd expect 704 people by chance alone to get at least four of the clock positions right. Actually, 743 got at least four right. That's more impressive than it seems, because the odds against this are high: 16 to 1. But, according to scientific tradition, it takes 20-to-1 odds to establish statistical significance, in this case to justify a claim that we've confirmed readers' psychic powers. While we cannot declare that *Omni* readers managed to peer into the future, the results we received from our Psi-Q I test were promising.

Many parapsychologists say that psychic phenomena exist. If this is so, the question now becomes: Why did Psi-Q I not reveal any psychic skills? In most psi experiments people perform psychic tasks better when they have a high level of interest in the project, when there is a strong emotional content associated with the target, when a supportive environment exists, and where they get good and timely feedback. Even the attitude of the researchers appears to have an influence on an experiment's outcome.

Yet to get a statistical experiment that will stand up to scientific scrutiny, participants are usually presented some form of mathematical puzzle—guessing a sequence of numbers, for example—and the experimenter then uses a random-number generator to produce the answers. The question we faced was: Could we compensate for the inherently dry nature of such mathematical tests? We thought we could if the critical factor was the way the test was presented. To try out this idea, we considered the special interests of *Omni* readers and couched the future-seeing task in an adventure story about finding a monolith in space. We hoped this would produce a higher level of interest and help stir the test taker's imagination.

Beneath the story, however, the challenge still required each test taker to predict 5 locations out of a possible 12. At the time we asked this question, this pattern did not exist. It wasn't until all the test responses were received that a random-number generator produced the targets. The computer then compared them with the test takers' predictions.

The weak link here was that, no matter how we dressed up the presentation, the target still existed only in the electronic space of a computer's circuitry—a concept singularly devoid of emotion. It is very scientific to use a random-number generator, but it is perhaps too abstract and dull from the perspective of a psychic. This is even more true when one is

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# MIND OVER IMMUNITY

# THE BODY

By Caroline Rob

Hay fever sufferer Bill Dugin starts to wheeze and sneeze as soon as a televised commercial advertising cereal shows a rich, golden cornfield aquiver in the summer breeze Carrie Costello breaks out in hives when her former boyfriend calls And Mary Dine's arthritis flared up worse than ever after her son's arrest

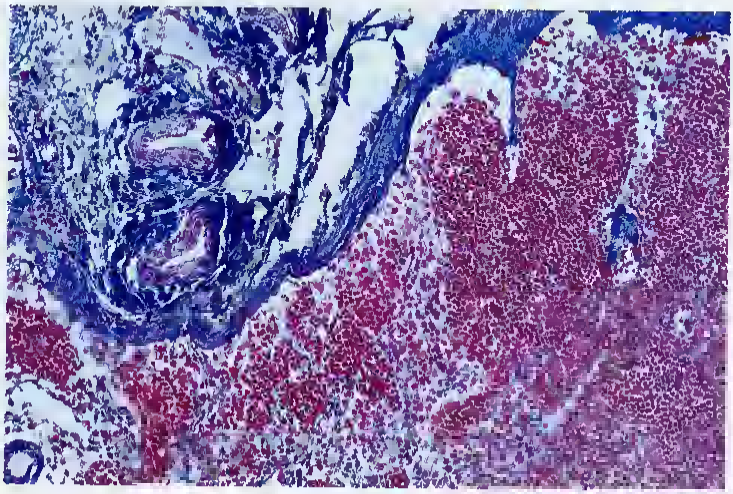
These are extreme cases of mind over body, but many like them have been recognized for centuries How anything as insubstantial as a thought can translate so quickly into physical symptoms has always baffled the medical profession Now a pioneering group of psychiatrists immunologists, and neuroscientists has at last begun to unravel the mystery

Working in a new discipline called psychoneuroimmunology (PNI) these scientists have discovered that the brain and the immune system are wired together in ways never before suspected Messages from the brain can travel almost instantly to the immune system and thus influence its myriad workings An urgent call from the brain can rouse the cells that attack viruses and other things that cause disease Brain messages can also harm the body overstimulating the immune system and causing psychosomatic illness

That the mind can influence immunity at all is an extremely radical notion The immune system has always been considered totally independent in its role as the body's defender So far not one immunology text has mentioned the discovery of a link between the mind and immunity, psychosomatic diseases are undeniable, but they have been explained away by other mechanisms

In recent years, though, the immune system has proved to be amazingly more complex than anyone had imagined And instead of concentrating on what influences it from outside, investigators have been drawn to the system's innermost workings

Robert Ader professor of psychiatry at the University of Rochester, New York, did much of the early work in PNI and is widely considered to be its founder



*Photographs of lymph nodes show what appear to be nerve fibers coupled to immune cells*

His book *Psychoneuroimmunology* (Academic Press 1982) has both drawn attention to the new science and given PNI research itself a boost To compile the volume, Ader sought out researchers whose work would complement his ideas about the mind and immunity In doing so he brought together scientists who would otherwise have remained locked inside their own disciplines The result has been a burst of new activity in the field

Ader backed into immunology ten years ago while conducting a classically Pavlovian experiment He gave some lab rats a deliciously sweetened drink laced with a bellyache-inducing drug The rats he expected, would soon learn to avoid the drink, no matter how good it tasted The surprise came when he cut down the concentration of the drug and gave the animals more of the drink itself Though the rats got no more of the drug in all several of them fell dead

Then Ader learned that the drug, cyclophosphamide suppresses the immune system And that explained it The rats had learned to associate the sweetener with the drug the more sweetener they drank the more drug they assumed they'd had And this assumption had somehow been conveyed to their immune systems So when they drank enough sweetener even though it contained only a small quantity of the drug, they reacted as if a whopping dose of cyclophosphamide had destroyed their immune systems

Ader teamed up with immunologist Nicholas Cohen, also at Rochester and the two went on to show that the mind can be conditioned to alter a number of immune responses Ader says however, that, "although it's an inescapable conclusion that the mind affects the immune system, our ignorance of exactly how this happens is still profound "

Yet scientists already have discovered at least a few clues about this process Terry Strom a Harvard University immunologist reports that chemical receptors designed to attract specific brain chemicals have been discovered on some immune cells It may be these

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# THE ARTS

By Bill Moseley

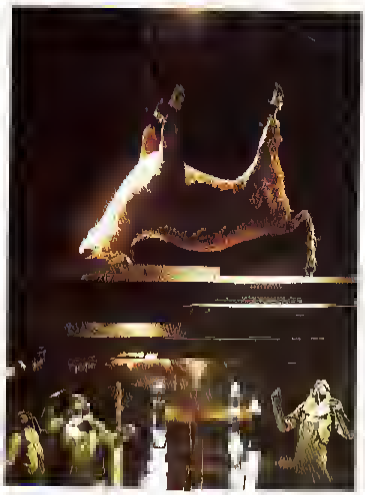
So who's really mutilating all those cattle anyway? Organ-starved aliens? Blood-drunk Satanists? Deranged medical students? According to the government, it's natural predators. According to Metro-Coldwyn-Mayer's forthcoming science-fiction thriller *Endangered Species*, it's a shadowy bunch of mercenaries practicing germ-warfare experiments in preparation for an eventual assault on Moscow. I witnessed the final three days' shooting of *Species* last November at a deserted sugar mill near Longmont, Colorado, and came away wondering whether the whole "mute" mystery wasn't just the product of an overactive Hollywood imagination. Were it not for Linda Moulton Howe, who showed me her unsettling documentary the day of my departure, I might never again have believed in my neglected obsession.

For the past six years, beginning with a clipping from the *Washington Post* sent me by an acquaintance and culminating in a personal crusade against them during my tenure as editor in chief of the short-lived journal *CB Bible*, cattle mutilations have both fascinated and repelled me. I found it mind-boggling that since 1967 anywhere from 1,000 to 10,000 cattle in 40 of the 50 United States, Mexico, Canada, the Canary Islands, and countries in South America and western Europe had been surgically set upon by assailants that to this day have eluded one of the largest, albeit most uncoordinated, manhunts in the history of U.S. law enforcement.

The mutilators, dubbed "the night surgeons" by ex-Fug Ed Sanders, invariably strike after dark. They remove the left ear and eye, the tongue, the udders if a cow, and the genitals if a bull, core out the anus, drain the animal's blood, and whisk away the fetuses of pregnant cows. The night surgeons work silently and leave nary a track nor trace even though they attack a number of cattle in rain-soaked fields, feedlots, and pastures. In March 1980 a Cripple Creek, Colorado, rancher reported that his prize Arabian stallion was mutilated one night in a corral that was only 30 feet from where the rancher, his family, and his watchdogs slept soundly.

Within hours of a "classic" mutilation, the internal organs of the cow or bull turn to mush while the flesh remains firm, fresh, and oddly odor-free for upwards of 30 days. The carcasses repel carrion feeders. In one case a coyote was found to have circled a mute several times but went no closer than 20 feet. In another case flies wouldn't even land on a mutilated horse. Add to these incidents that the removal of the organs is done with a precision that surpasses the skills of the best surgeons, and you have the biggest mystery since Jack the Ripper or the Kennedy assassination.

At first it was thought that the mutes were the work of Satan cultists, out for blood and organs for their diabolical "moon moans," but as the instances of mutilations spread in the early Seventies, investigators began to see that no known cult, Satanic or otherwise, had the capital or expertise to carry out such a bizarre operation. Enter Uncle Sam. Who else had the cash and/or motivation to snip essentially worthless organs from America's cattle herds? Speculation had it that Pentagon-funded, helicopter-borne cow choppers were hopping from ranch to ranch under cover of darkness to obtain organs necessary for clandestine chemical/biological-warfare experiments.



*The movie was nicknamed "Altered Steaks."*

While most serious investigators now believe that the mutes are the work of radiation-wary extraterrestrials, Alan Rudolph, who cowrote and directed *Endangered Species*, decided that Uncle Sam was the perfect heavy for his cloak-and-laser melodrama. As Rudolph puts it, "If it is UFOs, it's like God did it. It's bigger than a few thousand cows. What I like about our theory is that you can apply all the things that should piss you off about the power structure of the times. This picture has as much to do with Ronald Reagan as it does with Snippy the horse [the first recorded animal mutilation, in 1967]."

By the time I arrived on the set a year ago, I was already intimately involved with *Endangered Species*. In November 1980 I provided producer Carolyn Pfeiffer with a dozen glossies of actual mutilations from my own collection, and in return she let me play a cabdriver in one of the film's Manhattan scenes. The final days' shooting was to take place in an abandoned missile silo in Colorado, home base for the mercenaries. When publicist Steve Rubin drove me, not to a missile site, but to the hulking, derelict G&W sugar-beet mill, I realized that for the next several days things might not be as they seemed.

Before I'd been even an hour on the set, I watched Bobby Sargent, the stunt double for Peter Coyote, who plays Steele, the mercenary leader, hurtle 50 feet from a catwalk onto a big, blue air bag. Then a dummy, doubling for Sargent, was thrown from the same spot, hitting the concrete "silo" floor with an inhuman thwack. The next shot had Coyote's head and chest smeared with stage blood, lying in a lifeless heap where the dummy had landed. Roger Creed, who used

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# THE ARTS

By Robert Rivlin

Use computers to assist in advanced automobile design? Of course. Computer-simulate images of outer space? Naturally. Computer-generate special effects for motion pictures? Just look at *Tron*. But children's Saturday morning cartoons such as *The Flintstones* and *The Smurfs* created with the assistance of an advanced computer-graphics program? The idea seems almost ridiculous, especially given the frivolous nature of the cartoon images themselves.

There is, however, nothing frivolous about the experimental project now under way at Hanna-Barbera Productions, in Hollywood, one of the country's biggest producers of cartoon animation. For the past year Marc Levoy, Chris Odgers, and Bruce Wallace, who had been working on the Cornell University computer graphics program, have been writing software for a computer system at H-B to help create animated sequences with Fred Flintstone and the rest, using the computer's database and numerical processing abilities. And though Levoy, Wallace and Odgers consider themselves more mathematicians and computer programmers than cartoon animators, they are proving once again that computers can play a central role in the creative process.

The Hanna-Barbera project is under the personal supervision of company president and cartoon-industry giant Joe Hanna, who originally commissioned the experiment and still maintains some ties with the Cornell University program. But the ties are those of shared information, not physical setup. Integrated within Hanna-Barbera's extensive production facility, the computer-graphics project bears little resemblance to the sterile, clean-room environment in which many computers are found. Space was set aside within the existing studio facilities, and the computer project moved in.

Indeed this reflects the computer project's aim. "We're not out to replace the cartoon animator," Levoy emphasizes. "Our goal is just to relieve him of some of the horribly tedious, boring, and repetitive work that normally goes into hand-coloring each of the cels in an animation sequence." The computer-graphics process also permits the direct recording of cartoon sequences onto videotape instead of having each frame first shot on motion picture film.

The first step in the experiment was an intensive study of the conventional animation process—a technique that has changed little since the first films were made. The illusion of movement, of course, is created by changing the drawing slightly from frame to frame, the eye's persistence of vision retains the previous image when the new one is presented, and the visual cortex perceives the difference between the two as movement.

One of the first programs written by Levoy, Odgers, and Wallace at H-B was an "electronic exposure sheet"—a word-processorlike system to help keep track of the thousands of individual pieces of artwork that go into a final production. (Each second of finished film has 24 frames, each requiring drawings for both the foreground and the background, which are created and manipulated separately.)

The exposure-sheet system also helps keep track of the different parts of the cartoon characters themselves; in Hanna-Barbera's limited animation process only the features of the character that are actually moving change from frame to frame. Levoy shows us a set of cels representing Fred Flintstone talking (the word *cel* comes from the cellulose out of which the acetate drawing sheets are made). Sandwiched together as they would be on the animation photography stand, Fred's components look like a complete figure. But he is actually made up of several different cels, some representing his facial features, some his arms and legs, some his torso. To make him talk, the animator doesn't have to change any of the cels except those representing the face. Then when Fred is done talking, a different set of changes will make his arms or his legs move. By not having to redraw the figure completely for each frame, hundreds of hours in this labor-intensive industry

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*Hanna-Barbera's new computer process makes Flintstones in a fraction of the old time*

# How to make a speech

**By George Plimpton**

*International Paper asked George Plimpton, who writes books about facing the sports pros (like "Paper Lion" and "Shadow Box"), and who's in demand to speak about it, to tell you how to face the fear of making a speech.*

One of life's terrors for the uninitiated is to be asked to make a speech.

"Why me?" will probably be your first reaction. "I don't have anything to say." It should be reassuring (though it rarely is) that since you were asked, somebody must think you do. The fact is that each one of us has a store of material which should be of interest to others. There is no reason why it should not be adapted to a speech.

### Why know how to speak?

Scary as it is, it's important for anyone to be able to speak in front of others, whether twenty around a conference table or a hall filled with a thousand faces.

Being able to speak can mean better grades in any class. It can mean talking the town council out of increasing your property taxes. It can mean talking top management into buying your plan.

### How to pick a topic

You were probably asked to speak in the first place in the hope that you would be able to articulate a topic that you know something about. Still, it helps to find out about your audience first. Who are they? Why are they there? What are they interested in? How much do they already know about your subject? One kind of talk would be appropriate for the Women's Club of Columbus, Ohio, and quite another for the guests at the Vince Lombardi dinner.

### How to plan what to say

Here is where you must do your homework.

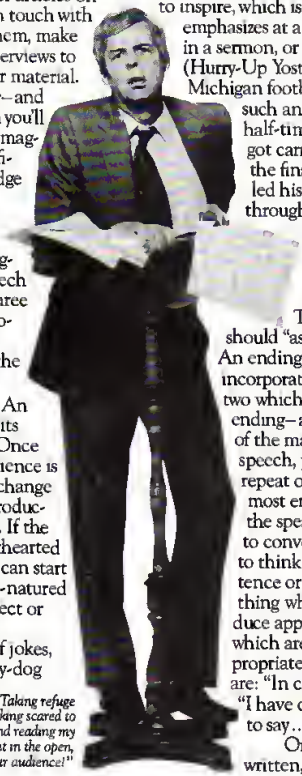
The more you sweat in advance, the less you'll have to sweat once you appear on stage. Research your topic thoroughly. Check the library for facts, quotes, books and timely magazine and newspaper articles on your subject. Get in touch with experts. Write to them, make phone calls, get interviews to help round out your material.

In short, gather—and learn—far more than you'll ever use. You can't imagine how much confidence that knowledge will inspire.

Now start organizing and writing. Most authorities suggest that a good speech breaks down into three basic parts—an introduction, the body of the speech, and the summation.

*Introduction:* An audience makes up its mind very quickly. Once the mood of an audience is set, it is difficult to change it, which is why introductions are important. If the speech is to be lighthearted in tone, the speaker can start off by telling a good-natured story about the subject or himself.

But be careful of jokes, especially the shaggy-dog variety. For some reason, the joke that convulses guests in a living room tends to suffer as it emerges through the amplifying system into a public gathering place.



*"What am I doing wrong? Taking refuge behind the lectern, looking scared to death, shuffling pages, and reading my speech. Relax. Come out in the open, gesture, talk to your audience!"*

*Main body:* There are four main intents in the body of the well-made speech. These are 1) to entertain, which is probably the hardest; 2) to instruct, which is the easiest if the speaker has done the research and knows the subject, 3) to persuade, which one does at a sales presentation, a political rally, or a town meeting, and finally, 4) to inspire, which is what the speaker emphasizes at a sales meeting, in a sermon, or at a pep rally. (Hurry-Up Yost, the onetime Michigan football coach, gave such an inspiration-filled half-time talk that he got carried away and at the final exhortation led his team on the run through the wrong locker-room door into the swimming pool.)

*Summation:* This is where you should "ask for the order." An ending should probably incorporate a sentence or two which sounds like an ending—a short summary of the main points of the speech, perhaps, or the repeat of a phrase that most embodies what the speaker has hoped to convey. It is valuable to think of the last sentence or two as something which might produce applause. Phrases which are perfectly appropriate to signal this are: "In closing…" or "I have one last thing to say…"

Once done—fully written, or the main points set down on 3"x5" index cards—the next problem is the actual presentation of the speech. Ideally, a speech should not be read. At least it should never appear or sound as if you are reading it. An audience is dismayed to see a speaker peering down at a thick sheaf of papers on the lectern, wetting his thumb to turn to the next page.

### How to sound spontaneous

The best speakers are those who make their words sound spontaneous even if memorized. I've found it's best to learn a speech point by point, not word for word. Careful preparation and a great deal of practicing are required to make it come together smoothly and easily. Mark Twain once said "It takes three weeks to prepare a good ad-lib speech."

Don't be fooled when you rehearse. It takes longer to deliver a speech than to read it. Most speakers peg along at about 100 words a minute.

### Brevity is an asset

A sensible plan, if you have been asked to speak to an exact limit, is to talk your speech into a mirror and stop at your allotted time; then cut the speech accordingly. The more familiar you become with your speech, the more confidently you can deliver it.

As anyone who listens to speeches knows, brevity is an asset. Twenty minutes are ideal. An hour is the limit an audience can listen comfortably.

In mentioning brevity, it is worth mentioning that the shortest inaugural address was George Washington's—just 135 words. The longest was William Henry Harrison's in 1841. He delivered a two-hour 9,000-word speech into the teeth of a freezing northeast wind. He came down with a cold the following day, and a month later he died of pneumonia.

### Check your grammar

Consult a dictionary for proper meanings and pronunciations. Your audience won't know if you're a bad speller, but they will know if you use or pronounce a word improperly. In my first remarks on the dais, I used to thank people for their "fulsome introduction," until I discovered to my dismay that "fulsome" means *offensive* and *insincere*

*"Why should you make a speech? There are four big reasons (left to right) to inspire, to persuade, to entertain, to instruct. I'll tell you how to organize what you say."*

### On the podium

It helps one's nerves to pick out three or four people in the audience—preferably in different sectors so that the speaker is apparently giving his attention to the entire room—on whom to focus. Pick out people who seem to be having a good time.

### How questions help

A question period at the end of a speech is a good notion. One would not ask questions following a tribute to the company treasurer on his retirement, say, but a technical talk or an informative speech can be enlivened with a question period.

### The crowd

The larger the crowd, the easier it is to speak, because the response is multiplied and increased. Most people do not believe this. They peek out from behind the curtain and if the auditorium is filled to the rafters they begin to moan softly in the back of their throats.

### What about stage fright?

Very few speakers escape the so-called "butterflies." There does not seem to be any cure for them, except to realize that they are beneficial rather than harmful, and never fatal. The tension usually means that the speaker, being keyed up, will do a better job. Edward R. Murrow called stage fright "the sweat of perfection." Mark Twain once comforted a fright-frozen friend about to speak: "Just remember they don't expect much." My own feeling is that with thought, preparation and faith in your ideas, *you* can go out there and expect a pleasant surprise.

And what a sensation it is—to hear applause. Invariably after it dies away, the speaker searches out the program chairman—just to make it known that he's available for next month's meeting.

George Plimpton

# THE ARTS

By Robert S. Ryan

Imagine a house with no rooms, or one built on a cloud. Imagine a house with a permanent shadow, day and night. These speculations are but part of the world of possibilities conceived by the visionary architect Raimund Abraham who has been in this country since 1964.

Rarely does an artist's speculation affect the observer more directly than in that convergence of art and technology, architecture. We can choose to ignore a gallery or museum exhibit, a play, or a novel, but it's difficult to ignore the presence of the buildings around us.

In the earliest years of the twentieth century the French architect and theoretician Le Corbusier envisioned a series of buildings, called "machines for living," unlike anything existing at the time. He developed a blueprint that he called "The Radiant City," made up of skyscrapers as high as, and even higher than, today's soaring Sears Tower, in Chicago. Because Le Corbusier drew his cities, instead of building them, his ideas at first were dismissed or acknowledged with wry ridicule by his contemporaries. Today the power of this artist is no longer in question. His imaginary city, though never constructed, was one of the main sources of the International Style, which rose from the rubble of World War II to dominate the architectural imagination for nearly a quarter of a century. If you've seen the glass-and-steel skylines of any large city, or the corporate towers that stand like sentinels on suburban landscapes, you're acquainted with the results of Corbu's unrealized plans.

Abraham, a foresighted architect of the waning days of the twentieth century, shuttles between Berlin and New York, working on the problems of an architecture that is scaled "down" to human nature, human bodies, human history. "We are in the presence of a master poet-architect when we observe, inhabit, and absorb Abraham's images," says John Hejduk, dean of the school of architecture of Cooper Union, in New York.

Abraham, born in the Austrian Tyrol in 1933, felt no particular leaning toward architecture until his university days. There was, however, a childhood pastime that strongly influenced his later work and thought. "Going mountain climbing with my uncle when I was a kid was the foundation of my perception," Abraham says. "Your life starts to depend on one little crack in the rock. There, in that rock, I learned how to focus and to truly 'see' with more than the eyes. Then the most influential thought in my early years of high school," he continues, "was the geometrical definition of infinity—that two parallel lines meet at infinity. You know that the two lines never meet physically, only theoretically. The roots of architecture are not in the hut or the primitive dwelling, but in the invention of surveying. Architecture is the language where that theoretical phenomenon takes place, almost as on a stage. You have physical evidence of the meeting of the two parallel lines."

In his studio today, with working drawings and books covering every available space, he describes architecture in terms of "intervention," "conquering a site," and challenging the "ultimate site," the horizon line. Abraham follows in the footsteps of such architectural seers as the Italian Futurist Antonio Sant' Elia, who rendered drawings for a Milan of the future but died too soon for them to be executed, and Buckminster Fuller.

The beginnings of Abraham's fantastic approach lie in some fairly spectacular "cities." In the early 1960s he produced a series of drawings, collages, and detailed plans to which he gave names like "Radar Cities," "Moon Crater City," and "Universal City." Urban designers and architects for centuries had drawn up their utopian dreams of cities, in the early Sixties the ideal of an effective and comprehensive city plan was sought like a Fountain of Youth. But Abraham's cities were drawn along entirely different lines. "These were 'autonomous' projects, autonomous in the sense that they were developed independently of any social or economic speculation on my part," Abraham explains. "They were a statement of negating the professionally accepted approach to city planning. My motivation had more to do with machines—as a

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*Designer Abraham's Ideal Houses "I was trying to monumentalize single events," he says*

ANTIMATTER ROCKETS

# BREAKTHROUGHS

By Robert L. Forward

An antimatter 'factory' in Geneva, Switzerland, is producing millions of antiprotons a second in research that could lead to remarkable new rocket fuels. Barely a thousandth of an ounce—30 milligrams—of this antimatter would be enough to propel a spacecraft to the moon. Ten grams—about the weight of 15 shelled peanuts—could take us to Mars.

Antiprotons are elementary particles with the mass of protons. But, unlike the proton, one of the building blocks of the atom, the antiproton has a negative charge. Collisions between protons and antiprotons result in a 100 percent conversion of particle masses into energy. The high conversion rate means that a tiny amount of fuel can be used to heat a larger amount of plain water to produce a blazing hot rocket exhaust (see 'Antimatter Revealed,' November 1979).

The factory for antiprotons is in operation at the European Organization for Nuclear Research (CERN). There, every 2.4 seconds, a pulse of 10 trillion ordinary protons strikes a tungsten target to produce 200 billion antiprotons. Some of these high-speed antiprotons are captured and held in a magnetic racetrack storage ring. Every 2.4 seconds another batch of antiprotons enters the ring, so that 40 hours and 60,000 pulses later there are a trillion antiprotons circling in the magnetic field. Although a trillion antiprotons weigh only about two trillionths of a gram, they contain a measurable amount of energy. If they were used to annihilate a trillion normal protons, 300 joules of energy would be released. That's the equivalent of exploding a tenth of a gram of TNT—approximately the modest 'bang' of a cap pistol.

Scientists are looking well beyond mere cap-pistol power. NASA and the Air Force are currently planning studies to explore the concept of antimatter propulsion in detail. The remaining challenge: Although the CERN machine makes lots of antimatter, the process it uses to capture the antiprotons is inefficient. Only 1 in 10,000 of the antiprotons generated makes it to the storage ring. The Air Force and NASA studies will look into how to capture more antiprotons, how to slow and stop them, and how to combine antiprotons with antielectrons (positrons) to make tiny antihydrogen ice pellets. These could be stored, by using magnetic and electric forces, and eventually carried into space in ultracold Thermos jugs: fuel cells for the next generation of rockets.

*CERN antiproton factory. Ten grams of fuel could thrust future spacecraft to Mars.*

## NEW PRODUCTS

Thanks to technology, modern spies not only can come in from the cold, but they can be downright debonair. With a camera disguised as a handsome chrome cigarette lighter, sneaking a snapshot is as easy as offering someone a light. The SC5000 camera/lighter is fueled with ordinary butane gas and takes 36 black-and-white or color photographs using Minox-type film cartridges. The camouflaged camera's special nylon gears operate silently. ($195, from Electronic Security Countermeasures, Inc., 345 West Forty-fifth Street, New York, NY 10036.)

The home computer has created a unique interior-design problem. How do you make computer components fit in with typical home decor? A California company has come up with a solution, called Electroniture. One piece is a Danish-style solid-oak unit with surface space for the computer keyboard and printer, a nook with a nonglare glass window for the display monitor, and a storage area for disk drives and a software library. A separate oak printer stand is also available. For those with less traditional taste, the company is currently working on some spacy-looking designs. ($895 for desk unit and $225 for printer stand, from Bench Collection, 1387-D Cass Road, Santa Rosa, CA 95401.)

The Star Time machine looks like a cross between the time-honored Wurlitzer and a video game. Not only does it play music, it also displays video performances. The heart of the high-tech jukebox is a patented random-access programmer/controller called the Video-Dex. The Star Time Video Muzzikbox/

CONTINUED ON PAGE 178

# CONTINUUM

## DNA WARS

It's 1996, and tensions between Libya and Chad have heated to a boil. Moammar Kaddafi decides to invade Chad, but first he softens up the enemy with a little something he bought from the French. It's a colony of *Salmonella typhosa*—the bacterium that causes typhus—genetically altered to resist typhoid vaccine. Libyan agents dump gallons of the substance into Chad's major water supplies. The bacteria quickly multiply, spreading typhoid fever through the population. Thousands are suddenly seized with fever, diarrhea, and convulsions. Two weeks later the Libyan army invades. Inoculated against the new supergerm, they meet little resistance from Chad's dying troops.

Unfortunately, no one thought to inoculate the populations in surrounding countries, and soon typhoid fever burns across Nigeria and Sudan. Hundreds of thousands die as Africa suffers an epidemic rivaling what medieval Europe suffered during the Black Death.

This scenario may seem like medical fiction, but it's close enough to reality to scare some of America's top biologists. Several, in fact, have issued warnings strangely reminiscent of the fears Albert Einstein expressed about the impending atom bomb. Today's alert? Don't create disastrous new weapons with recombinant DNA.

People have been concerned about genetic engineering ever since scientists first transferred parts of DNA—the molecule of heredity—from one cell to another in the early 1970s. Suddenly cells took on startling new characteristics. Common *Escherichia coli* bacteria, for example, can absorb the gene for insulin, then start producing relatively large amounts of that critical enzyme for diabetics. Other bacteria can be outfitted with genes that help them digest oil spills or hazardous chemicals. The bad news is that scientists can also produce a new breed of biological weapons—toxic bacteria and viruses resistant to virtually all medication, except for an antidote manufactured by the attackers themselves.

DNA weapons, says Dr. Raymond Zilinskas, of the Congressional Office of Technology Assessment, would have a special appeal to any budget-minded dictator bent on world domination. The $50 million it costs to set up and run a DNA-weapons lab is a bargain compared to the billions it would take to develop a nuclear bomb. 'And ultimately there exists a chance that bacterial strains resistant to all antibiotics could arise, thereby plunging mankind into a time resembling the pre-antibiotic era.' In other words, welcome back to the world plague.

Though DNA warfare was banned by the Biological Weapons Convention of Krimsky, a Tufts University professor and former member of the National 1972, activities at the U.S. Army's Medical Research Institute, at Fort Detrick, Maryland, are giving scientists cause for concern. In one study, for example, researchers are genetically engineering harmless *E. coli* bacteria to produce anthrax, a deadly animal disease, considered one of the most potent germ-warfare weapons around. Using similar techniques, personnel at the Fort Detrick lab are studying the enzymes that react with nerve gas and brewing bacteria replete with genes for Rift Valley fever, a scourge of East Africa and the Middle East.

Army spokesmen say this research is perfectly legal, since it will be used to find antidotes for biological weapons created by our potential enemies. Current research, they add, is sure to be a boon to civilians as well. In fact, they contend that the quantities of disease-infested bacteria made in the lab will help them test new or better cures more efficiently than ever. Current gene-splicing work, the Army is quick to add, has been approved by the National Institutes of Health.

But many scientists are skeptical. 'Once we've made huge quantities of these viruses and bacteria, even if just to find possibla cures,' says Dr. Sheldon Krimsky, a Tufts University profassor and former member of the NIH's DNA advisory committee, 'we've made potent new weapons as well. "The Army can produce some pretty outrageous organisms,' says Krimsky, "in trying to anticipate what an aggressor might do.'

For a couple of years now scientists have issued quiet warnings about recombinant-DNA research in scientific journals. Recently the issue came to public attention when the DNA advisory committee formally reminded the military that bioweapons research is prohibited by the 1972 convention. How long will such gentle reminders suffice? "I just don't know what the answer is to that," says Dr. William Gartland, Jr., the current director of the National Institutes of Health's office of recombinant-DNA activities. 'If the Army really wanted to do the research, they could just go ahead.'—*DOUGLAS STARR*

# CONTINUUM

## FIRE-ESCAPE CHUTE

A fiery blaze has broken out in your office building So you rush to a steel cabinet under a nearby window remove a 15-story chule, and lower it to the ground In quick succession you and your office mates slip into the chule feet-first and drop ten feel a second to safety

The Japanese-made vertical chule that offers this speedy escape from inferno is a tube of synthetic fabric encircled by stainless steel coils that hug your body and slow your descent The going is so easy in fact that hundreds of Japanese, including children,

*Japanese chutes Dropping at a safe ten feet per second*

a blind man and an eighty-one year-old woman have already chuted to safety from burning hotels hospitals and factories

Manufactured by the Uyeda Escape Chute Construction Company the tubes are now available in the United States

—Carol A Johmann

## NEW HERPES DRUG

When herpes simplex virus invades a human cell it captures genetic machinery and activates the manufacture of new strands of herpes The result an outbreak of painful and infectious skin sores

Until now drugs effective against herpes have proved unacceptably toxic But researchers at Burroughs-Wellcome Corporation in North Carolina have recently developed acyclovir (ACV), a safe oral capsule that prevents herpes reproduction and the continued flare-up of infection According to Dr Ronald Keeney of Burroughs-Wellcome, ACV works by attaching to the growing end of the herpes virus strand The virus simply stops growing Keeney says, 'and essentially commits suicide

Burroughs-Wellcome is marketing a prescription ointment made from ACV called Zovirax that reduces the duration and severity of herpes sores The pharmaceutical firm hopes that the Food and Drug Administration will approve a more powerful form of the drug by 1983 —Eric Mishara

*Electrical stimulator Used at night the electrodes produce forceful muscle contractions to offset the bending of the spine*

## ELECTRIC SCOLIOSIS CURE

To the 50 000 American children suffering from curvature of the spine or scoliosis, the disease means frightening painful surgery or years of wearing clumsy unsightly back braces But a promising new treatment boasts a 98 percent success rate at halting the progression of the disease painlessly with electricity while the children sleep

Invented by bioengineer Jens Axelgaard at Rancho Los Amigos Rehabilitation Engineering Center in Downey California, the battery-operated device stimulates the back with electrodes that produce forceful involuntary muscle contractions to offset the bending of the spine

'It s a big plus compared to the brace ' Axelgaard says Unlike the brace which merely supports the spine in a near-normal position the electrical stimulator actually strengthens back muscles Because it is used only at night the child is free to participate in normal daytime activities including competitive sports

The treatment Axelgaard says, might also be used to maintain the muscle tone of comatose patients arthritis sufferers and injured athletes 'In the last instance ' he notes ' you can just hook the stimulator under the cast and when the cast comes off, the muscles will be as good as new

The device may be marketed next year pending approval by the Food and Drug Administration

—Sy Montgomery

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*The intensity of the conviction that a hypothesis is true has no bearing on whether it is true or not '*

*—Sir Peter Medawar*

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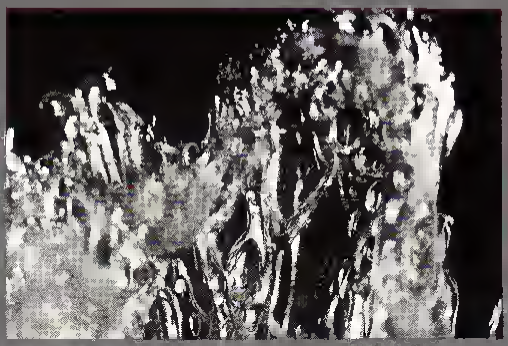
*"When people are awake, they enjoy one world in common but asleep, each roams a world of his own '*

*—Heraclitus*



*Polymer: A wondrous material for making lightweight planes but with age it loses its ability to stretch and may even fracture*

## DANGEROUS POLYMERS

Some of the polymeric materials used to build lightweight aircraft military equipment and electronic circuit boards can become brittle with age, a team of Virginia Polytechnic Institute researchers warns

In a study supported by NASA and the U S Navy, chemical engineer Garth Wilkes and chemist James McGrath found that glassy network polymers (epoxy) can change over time These polymers can begin turning brittle in as little as two months Wilkes claims—a fact many mechanical and aeronautical engineers were surprised to learn When we told NASA they perked up ' Wilkes says

As the materials age they can show a decrease in the ability to stretch or deform an increase in their tendency to fracture and other changes Polymers are commonly being used in wings fuselages, and other plane components

'As a passenger on an airplane, I would begin to worry about flying in a craft several years old that had been built with some of these new materials unless they had been tested appropriately' Wilkes admits

Nevertheless he adds, with proper design and testing procedures to ensure that a given material is suitable for its application, these same polymeric materials 'may well provide the best route for producing low-weight transportation in the future' —Allan Maurer

*"They that can give up essential liberty to obtain a little temporary safety deserve neither liberty nor safety'*

*—Benjamin Franklin*

*"Television? No good will come of this device The word is half-Greek and half-Latin'*

*—C P Scott*

## STUD DRUG

A constant diet of marshmallows and chocolate chip cookies would fatten anyone Or would it? In a series of experiments done at Temple University in Philadelphia obese and impotent male rats dined exclusively on this regimen of sweets But daily injections of naloxone, a drug used to treat heroin addicts transformed them into sleek studs that copulated like crazy And, according to Temple psychologist David Margules naloxone could be modified to produce similar results for men

Obese humans and rats manufacture huge quantities of a hormone called opioid-peptide Margules explains When this natural relaxant attaches to receptor molecules in the stomach and brain people feel 'as if they ll die unless they eat And when it attaches to similar receptor sites along the sperm duct men cannot ejaculate

*Marshmallow and chocolate chip cookies A diet for studs?*

But when naloxone is injected into rats Margules says it seals off the receptor molecules effectively disarming the hormone Even when freely supplied with normally enticing sweets the rats eat less become sexually active and burn up more calories

Margules cautions that naloxone is not effective against primary impotence where the male is unable to produce the essential sex hormone testosterone Meanwhile Du Pont, which developed naloxone is testing the clinical applications of an oral version of the drug known as naltrexone —Eric Mishara

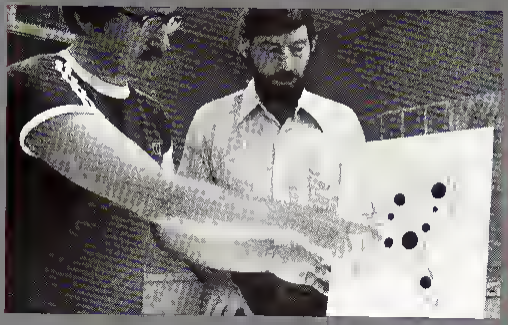
*Any machine is a concept of a human designer it reflects the human brain be it wheelbarrow or giant computer So there is nothing mysterious in a machine designed by a human showing self-awareness I used to have a folding camp cot that liked to bite me I don t say that it was aware but I learned to approach it with caution*

*—Robert A Heinlein*

*God looks after drunks children and Americans*

*— James Truslow Adams*

# CONTINUUM



*University of South Carolina cartographers Using computers to test how well map symbols communicate the right information.*

## BETTER MAPS

Even with a map in your hand you may become lost on an unfamiliar route But once you have formed mental images of a route, you don't need a map at all

Two University of South Carolina cartographers Robert Lloyd and Theodore Steinke are using a computer to study the way people form and use mental images of maps Eventually,' Steinke says this may change some of the conventions of map making and the way map reading is taught These conventions evolved over hundreds of years but were not established in any sound scientific way"

"We don t know how people read maps or how they think when they process information Lloyd says 'If we knew we could improve maps to make the information easier for people to understand

In one experiment subjects respond to dots flashed on a computer-screen map by identifying each dot's regional location The computer measures the response time in milliseconds

Another test measures how well symbols communi cate the information they should, circles indicating city size for example

Findings so far in the two-thirds complete study indicate that people use images not verbal thinking to understand maps

' This is only a first step ' Steinke explains "It will be some time before studies of this sort lead to practical changes in map making '

So why hasn t anyone examined this problem before? Steinke offers several reasons First, the experiments are time-consuming and only the computer makes them feasible Second there are very few academic cartographers 'Most cartographers are busy cranking out maps," he says —Allan Maurer

' *Language is fossil poetry* " —*Ralph Waldo Emerson*

## PLEASE, NO BREAKTHROUGHS

Are you anxious to publish your paper on a possible cure for cancer? A technical report on a startling new energy source? A promising approach to a unified-field theory?

Chances are your Nobel Prize-winning research will earn you nothing but rejection slips That's the conclusion of J Scott Armstrong a professor of marketing at the University of Pennsylvania's Wharton School and the editor of the *Journal of Forecasting*

Armstrong recently analyzed research on what is getting published in scholarly journals He found that your chances of being published increase if you write about an unimportant topic or at the very least write unclearly about an important topic It also helps to agree with existing beliefs use convoluted methods and write in a stilted unfathomable style Never, never, Armstrong warns, obtain surprising results

He cites one study in which 12 already-published papers containing important results or well-received theories were resubmitted to a variety of journals (the names of the authors had been changed) Only 3 of the 12 were detected by editors as plagiarized One was accepted for pub lication and the eight others were rejected

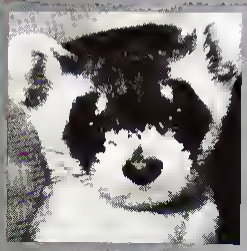
Armstrong has a final tip for researchers When writing papers hold back some important data That way he says, you can publish again with "new' findings that are really the rest of your original paper.—Nick Engler

## BLACK FERRETS

The black-footed ferret lives

A minklike animal once common in 13 states, from North Dakota to Colorado the black-footed ferret is near the edge of extinction because of mankind's encroachment on its prairie domain But Wyoming wildlife biologist Timothy Clark says it is not as once feared already gone

After a rancher discovered



*Endangered ferret Not enough prairie dogs to eat*

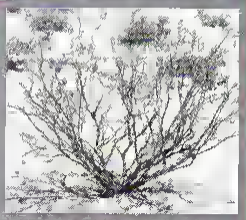
one of the animals killed by a dog in his yard, Clark, with the help of cowboys and others, began a tracking expedition Tracing footprints in the snow at daybreak, because the animal is nocturnal Clark found "an island population ' of about 20 animals in an isolated area near Cody, Wyoming

"This group may have persisted here for up to a hundred fifty years," Clark estimates Threatened by wolves, owls hawks foxes,

and man, the animal 'has been in trouble for about ten years "

Ironically, ranchers who poison prairie dogs the ferret's favorite prey, do so under a misconception, Clark says "They view the prairie dog as a threat to range grass Prairie dogs may eat grass but by burrowing they churn up the earth and increase the fertility of the ground "

Clark says more needs to be done to put the animal on the road to recovery "We need to learn more about it, the signs of its existence and then create a sound program to preserve it.'—Allan Maurer



*Desert creosote bush Nearly 12,000 years old*

## KING CLONE

Perhaps the oldest living organism on Earth is a scraggly desert creosote bush that has survived nearly 12 000 years

Dubbed King Clone by researcher Frank Vasek the University of California botanist who found it in the Mojave Desert, the plant was probably 'one of the first life forms to colonize the desert when the last glacier receded, and it has been a resident there ever since ' Growing in circular clusters that are direct offshoots or clones of the original, the creosote bush spreads nearly 70 feet in diameter

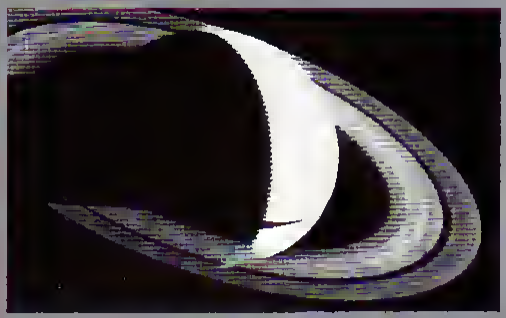
Vasek s associate, Lionel Sternberg, developed a method for "fingerprinting the bushes by testing plant enzymes Clones have identical enzymes while other plant clusters differ in this respect

Dating the plant required two methods "The plant is like a fairy ring You drop a pebble in a pond and see the spreading waves but there s nothing in the center " Vasek says The ancient wood rotted away, eliminating the growth record It continued to clone itself by sending up sprouts or touching down branches that took root at the outer edge of the rings

By counting growth rings in existing bushes, which like trees add one ring a year, and then measuring the distance of annual growth, Vasek obtained one dating method He also used radiocarbon dating of wood chunks from the center of the rings

What is the secret of the plant's longevity? 'It s half-starved and grows slowly in a harsh environment,' Vasek says "We see this throughout nature Plants that have a hard time grow hard and dense in the worst places But they're the oldest organisms on Earth —Allan Maurer

*"The nearest thing to immortality in this world is a government bureau "*
*—General Hugh S Johnson*



*Saturn Mysterious music from the rings, with bell like sounds as well as humming tones that start and stop for no apparent reason*

## SYMPHONY OF SPACE

Hummmmmmmmmmmm Pop! Rrrrrrrrrrrng Chirp!

Those are the crazy sounds of the solar system and to one scientist they are music to the ears

While others have been busy analyzing the incoming visual data received from the *Voyager 2* spacecraft sailing past Jupiter and Saturn, TRW scientist Fred Scarf of Los Angeles, has been sorting out the incoming audio, and with some surprising findings

Scarf uses an instrument called a plasma-wave system to pick up radio and sound waves moving through the gas or plasma, of interplanetary space After the waves have been beamed back to Earth, a microcomputer and music synthesizer turn them into symphonies of birdlike chirps booming bass notes even haunting whistles

The radio and sound waves emanate from the solar winds currents of electrically charged particles composed of electrons protons and ions that eventually wind up oscillating ' in a planet s magnetic field "Electrons vibrate with a higher frequency and so they make the highest-pitched sounds Scarf says Protons are tenors and the heaviest particles the ions are the basses

Scarf notes that the sounds of Jupiter were particularly thrilling' because he didn't expect to hear them so distinctly "There were whistles from lightning, and a whole chorus of other sounds

Much of the music of Saturn he adds seems to develop within its ring system and these noises are the most mysterious Saturn's music is low and deep he says There are bell-like sounds as well as humming tones that start and stop for no apparent reason—Marc McCutcheon

*"If fifty million people say a foolish thing, it is still a foolish thing "*
*—Anatole France*

# CONTINUUM

## HURRICANE CASTLES

In medieval times castles were constructed to protect the inhabitants of towns from danger Modern coastal cities should do the same to give people refuge from hurricane destruction a Florida storm specialist recommends

"Large coastal communities should have safe havens that could withstand anything a hurricane throws at them ' says D Lee Harris, chief of storm surge research for the National Weather Bureau from 1953 to 1967 currently with the University of Florida

Predicting the path a hurricane will take is still an inexact science that requires "warning five times as many people as necessary ' Harris claims ' The average error in a twenty-four-hour hurricane position forecast is one hundred nine miles, and there s no reason to expect this to improve soon,' he says

This means people don't always have time to evacuate inland and other methods of protection should be sought, Harris asserts

He recommends that coastal cities beef up their building codes and conduct more rigorous inspections Hotels courthouses or municipal buildings should be built or reinforced to provide shelter

Hurricane forecasts will not improve much unless there is a major scientific breakthrough, he believes but people can be protected —Allan Maurer

*' A handful of sand is an anthology of the universe "*
*—David McCord*

*"Do not try to live forever You will not succeed "*
*—George Bernard Shaw*

*Because the average error in hurricane forecasting is 109 miles one scientist suggests building impregnable storm shelters*

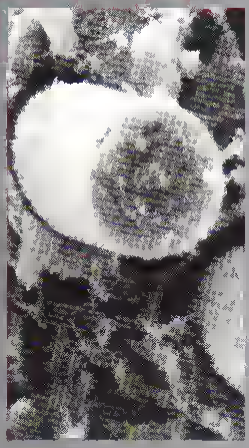
## REGENERATING KNEES

For nearly three years after his car accident, eighteen-year-old Michael had to walk with crutches Neither nature nor five operations could repair the torn ligaments that had once connected his knee bones

Torn ligaments, connecting bone to bone, and tendons, connecting muscle to bone have been the bane of orthopedics since the specialty was born Once damaged, these elastic fibrous structures composed of collagen grow back poorly, if at all Ligament and tendon grafts from cadavers usually are rejected by the body Grafts from the patient s own body merely shift the problem from one place to another Synthetic replacements don't work, either because if they don't fall apart they cause abnormal growth in the tissues that surround them

Yet Michael is jogging now thanks to a new concept developed by a team at the University of Medicine and Dentistry of New Jersey After five years of research, the Newark, New Jersey, specialists have combined a synthetic implant with the body's own repair processes to do what neither alone could do before grow back brand-new ligaments and tendons as strong as the originals

The implant is a strand of 10 000 hair-thin carbon fibers that, when sewn in place connect the torn ends of a ligament or tendon Since the implant contains no protein it isn't rejected by the body Instead it attracts thousands of fibroblasts cells that normally collect along fibers to produce collagen The fibroblasts secrete collagen along the implant fibers until within a few weeks, the tendon or ligament has healed



*Tendon Elastic, fibrous, and the bane of orthopedists*

Under the direction of Drs Andrew Weiss, Harold Alexander and Russ Parsons, the implants have been successfully made in more than 100 American patients in New Jersey, Texas, and California, now 20 surgeons in various parts of the world are using the experimental technique, and the researchers expect to submit their results for Food and Drug Administration approval late next year —Sy Montgomery

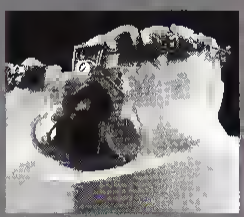
## ELECTRIC BRACES

Soon you may be able to zap your teeth with electric braces, improving your smile in about half the time it takes for regular braces to do the job

A team of engineers and orthodontists at the University of Pennsylvania has already successfully tested the device on cats Tests on humans are under way Added to regular braces the unit consists of three tiny batteries, a transistor and a resistor

No thicker than two nickels back to back, the device hides under a patient s lip How does it straighten teeth? Dr Zeev Davidovitch, who helped develop and test the invention, explains that electricity moves a tooth into position with double effectiveness On one side electricity makes the obtrusive bone recede and on the other it helps build new bone to solidify the tooth's new position "It s like a hot rock moving through a block of ice Davidovitch says "You re moving the hole and ice builds up behind it "

The constant current delivered by the batteries is only 20 millionths of an ampere Wearers won't feel a thing the researchers say —Allan Maurer



*Plastic case holds batteries a transistor and a resistor*

## HOMING MUSIC

Birds may navigate by listening to the sound of winds whistling over mountains, according to Dr Melvin Kreithen, of the University of Pittsburgh

Kreithen believes that the wind blowing over a high geological formation produces a sound just as a person's blowing across the top of a bottle does But bigger bottles register lower notes and huge valley-mountain systems Kreithen says generate unbelievably low frequencies

Kreithen has shown that his test birds have no trouble hearing sounds as low as three cycles per minute, and possibly lower His experiments stopped there because his sound equipment can go no lower

Many birds have built-in clocks and magnets that help them navigate a course, but there must be other systems at work Kreithen is convinced 'All the mechanisms we know about if we put them together are not enough for us to build a navigating machine '

Even though he knows birds can hear extremely low frequencies Kreithen is a long way from showing how—or even whether—they use them in an infrasound navigating system We don't even know " he says ' where the infrasound detecting organ is —Timothy Perrin

*Rockefeller mice The fat mouse survived canine distemper virus injected into the brain but now the mouse has a weight problem*

## VIRAL OBESITY

A recent experiment with Swiss albino mice at Rockefeller University in New York City indicates that the same viruses that cause the measles or the mumps may trigger obesity

Rockefeller researchers investigating the connection between viral infections and multiple sclerosis injected canine distemper virus into the brains of 120 mice About half the mice died of acute brain infections but the other half managed to survive Then about two months after the injections virologist Michael Lyons realized that many of the surviving mice were rapidly gaining weight Within four months 18 mice had become obese, some even doubled their normal weight

Scientific scrutiny revealed that the obese mice had an extremely low level of the brain chemicals called catecholamines which regulate eating behavior in both man and rodent

Lyons and his colleagues suggest that certain susceptible people may suffer an impaired ability to produce catecholamines as a result of viral infection And then perhaps as much as five years later they experience a dramatic increase in appetite and girth

—Eric Mishara

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*"The best way to make your dreams come true is to wake up '*

*—H M Power*

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*"Dreams are true while they last, and do we not live in dreams?'*

*—Alfred Lord Tennyson*

# CONTINUUM

*Infants need lots of physical affection, one neuropsychologist says, to avoid altering their brains and fostering adult violence*

## HUGGING PREVENTS BRAIN DAMAGE

Giving an infant lots of physical affection—hugging, kissing, touching, rocking—may prevent a type of brain damage that could later turn the child into a violent adult.

Neuropsychologist James Prescott has stated this theory in popular and scientific publications and in testimony before the California Commission on Crime Control. Depriving children of physical stimulation in their formative years "alters the microstructural development and functional organization of the brain," he declares.

Citing numerous studies in which monkeys and other animals were separated from their mothers, Prescott asserts that pleasure and violence have a reciprocal relationship. "One inhibits the other. Electrophysiological readings on monkeys separated from their mothers at an early age show abnormal spikes. They occur in the old brain or cerebellum. These animals also show a strong tendency to be violent."

In his own study of 49 primitive cultures, Prescott found that "when levels of infant affection are low, such as among the Comanches, levels of violence are high; when physical affection is high, such as among the Maoris of New Zealand, violence is low."

He concludes that "the influence of our environment seems to be imprinted on the structure of the brain which then shapes the environment. This he suggests can affect a society's choice of sexual mores, drugs, and entertainment.

—Allan Maurer

*"A drug is a substance that when injected into a rat produces a scientific paper."*

*—Anonymous*

## SYNTHETIC-LIFE MERCHANTS

Barely a decade old, the synthetic-life trade is spreading like a viral infection. Already at least 137 companies are working in genetic engineering, antibody production, and related technologies.

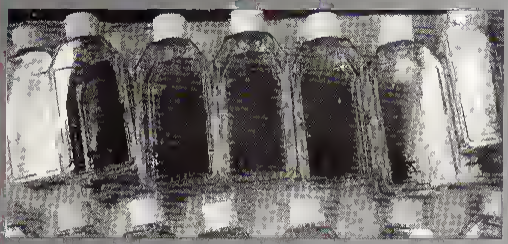
According to a Mountain View, California, business-consulting firm named Strategies Unlimited, we can expect the following biotechnological products in the near future:

- New drugs. Many will be based on natural body chemicals. Such hormones as insulin and human growth hormone are already being produced with the help of genetically engineered bacteria, and at least 20 more are under development. At least 15 companies are working with interferon, and Syntex, in Palo Alto, California, is trying to devise small, artificial molecules that will have interferon's virus-killing power.
- Oil-eating microbes. According to biochemist Ananda Chakrabarty, who developed one such bug at General Electric and has formed Illinois Petrogen, Inc., to market it, they can be used to extract new oil from worn-out wells, to digest sulfurous pollutants, and to clean up spills.
- New food crops. Some large firms working to better existing products include Campbell's Soup (tomatoes with more pulp and less juice), Frito-Lay (clones of disease-free potatoes for its chips), and Labatt Brewing (yeast that will produce higher-octane beer).

Also under development are such specialty products as bacteria that digest metal ores to cut the cost of refining (Biotechnology Australia, in New South Wales), encapsulated pancreas cells to help those who have diabetes (Damon Biotech, in Needham, Massachusetts), and a process for separating the x-chromosome and y-chromosome sperms of cattle semen (Genetic Engineering, Inc., in Denver).

For more information, you might buy a copy of the *Genetic Engineering Business Directory*, now available from Strategies Unlimited—for only $950.

—Owen Davies



*DNA cultures: Synthetic life has oozed out of basic-research labs and is rapidly spreading through the business community*

# GENETIC FORECASTS

*Peer into your genes, and learn what biofuture awaits you*

BY TABITHA POWLEDGE

Another dispatch from the genetic revolution: They're working on some stuff that will change the way you live. Literally. The idea is to predict years, or even decades, in advance what diseases you are most likely to contract and then fine-tune the world around you so those diseases can be prevented. Or at least treated earlier and more

PAINTING BY MATHIAS HOLLÄNDER

successfully than ever before

That s the good news The bad news about this genatic crystal ball is that the adjustments you'll be making will not necessarily be geared to your convenience

In a limited way we already make use of genetic information to peer into the future—and to help us take action to alter that futura To wit

- Women whose female relatives have had breast cancer are urged to see their physician regularly and to be conscientious about examining their own breasts
- The young sons of men who have a medical history of heart disease have been advised to exercise often refrain from smoking and adopt a low-fat diet for life
- Tens of thousands of pregnant women have undergone prenatal diagnosis Well over 95 percent of them have spent the rest of their pregnancies secure in the knowledge that their offspring would not be afflicted with a specific genetic disease while those less fortunate had the option of ending the pregnancy and trying again for a normal baby

Practices like these constitute the first tiny steps toward our genetic self-knowledge With ever-increasing frequency medical scientists—using blood tests and other means—are telling us a great deal about our future health or lack of it In only the last decade some 80 diseases have been traced to predisposing genetic factors and the hereditary components of dozens more disorders are being identified each year These insights into our personal biofutures may range from knowledge of our likelihood of developing cancer to our vulnerability to pollutants and certain mental diseases

The message here is *not* that we are what our genes make us Far from it The message is that if we know our genes we can exert some control over their actions Our futures are not dictated by implacable, immutable fate, but rather, within limits, they are our own, to fashion as we fancy

Take, for example, the devastating neurological disorder that killed the brilliant folksinger Woody Guthrie Formally known as Huntington's chorea, now simply called Huntington's disease, this affliction causes appalling mental and physical degeneration The children of people so afflicted have a 50 percent chance of developing the disease themselves—but usually not until the age of thirty-five or even later Thus, they must spend a considerable part of their lives in dreadful suspense about their own futures—and those of their children as well

Given frightening odds, a number of people at risk for Huntington's have decided against parenthood If it were possible to detect the Huntington's gene, this uncertainty would vanish The children of Huntington's patients could find out many years, or even decades in advance whether they would develop symptoms later in life And they could also have children and still retain a clear conscience because the presence of the gene could be detected in the fetus early enough for the pregnancy to be safely terminated In a single generation the diseasa might thus be wiped from the face of the earth

This might be accomplished if scientists were able to establish for Huntington's disease somathing that has come to ba known as a genetic marker This is a biological trait that acts in much the same way as a buoy anchored to a shoal or the flag on a golf-course green it is a visible signal giving evidence of something—in this case a gene for a particular trait—that is otherwise hidden from view

Markers can be of several different kinds By taking a blood sample for instance direct detection of the protein product made by a gene may be feasible Then one could conclude whether the gene is functioning as it should In the inherited disease sickle-cell anemia, the sickle-cell gene manufactures an abnormal hemoglobin that can be detected relatively easily if the abnormal hemoglobin is found the presence of the sickle-cell gene can be inferred indirectly from it Or with the help of new techniques being developed in the genetic-engineering field, such as recombinant-DNA the gene itself might be directly identifiable

Although the latter may eventually prove useful neither of these possibilities currently offers hope for detaction of Huntington s disease, because it is not yet known exactly which gane is responsible for the sufferar s erratic behavior and slow degeneration nor what product that gene makes or fails to make

Thera is another possibility however The gene responsible for a given condition, such as Huntington s may be located quite near a different gene that *can* be detected This gene usually will have no relationship to the gene in which we are interested except that of physical proximity It would for example play no role whatever in the actual davelopment of Huntington's disease

But becausa it is located near tha Huntington s gene both of these genes would tend to be inherited together Thus, if a marker were present in a particular Huntington's patient its presence in one of the patient s children would be a fairly reliable indicator that that child probably possesses the Huntington's gene, too, and would almost certainly develop symptoms of the disease later in life

It would not be an absolutely certain indicator, however, because in the reproductive process genes that are close together occasionally split up and go their separate ways But this event, called crossing over, is rare Therefore to regard the genetic marker as an indicator of the defect would pay off nearly always

Researchers have not yet identified markers for Huntington's disease, but eventually they will Not surprisingly the possibility that it will be detected long before symptoms are observed has already provoked controversy among those interested in the disorder, especially those who are at risk for it Not all of them are happy about the idea of learning that they possess the gene Some think living with uncertainty is preferable to knowing for sure that their lot is future misery and an early, agonizing death

Physician Stanley Fahn, of Columbia University, writing in the *New England Journal of Medicine*, has argued that many people "are not psychologically capable of handling this information and a positive result could lead to disastrous consequences, such as suicide

Madeleine Bates, a trustee of the national Committee to Combat Huntington's Disease a voluntary health agency, takes the opposing view She believes such a test should be available to those who want it because it would relieve the terrors of that 50 percent of the population at risk who will *not* develop the disease, and it could also help the carriers of the defective gene by enabling them to plan their lives better and to prepare emotionally "Giving the patient time to cope, prepare, and plan while still healthy may actually reduce the possibility of suicide,' she says

When it comes to the diseases in our future, is ignorance bliss? The dilemma of the person at risk for Huntington s will someday apply to us all As genetic markers proliferate both the individual and society will be confronted with a host of brand-new predicaments

Some of these will grow out of technical limitations Only rarely will possassion of a particular gene, or genes point to an inevitable outcome Even among that group of diseases we call genetic, involving a single gene or a major chromosome abnormality the clinical picture often varies widely Babies born with an extra twenty-first chromosome virtually without excaption have the condition known as Down's syndrome also called mongolism and as a result they are mentally retarded But some are profoundly retarded, requiring total support and care, whereas many others have I Q s close to the normal range can care for themselves participate in social and family life, and even marry and hold undemanding jobs

Still greater uncertainty surrounds the newly discovered relationship between a number of puzzling diseases and the histocompatibility gene complex, known as the HLA system This group of genes is located on chromosome number six in man But their presence can easily be confirmed because they code for special molecules, called antigens, which sit on the

surface of cells and serve a function analogous to identity tags. One combination of antigens covers all the cells in the body—a configuration as unique to the individual as fingerprints. Similarly the outside coats of bacteria and viruses display a different, highly specific constellation of antigens. By comparing such molecular monograms our immune systems can distinguish "self" from all foreign matter.

Until about 1970 the HLA system was chiefly of interest to transplant surgeons who used these antigens to test for tissue compatibility between potential organ donors and recipients. But in recent times these antigens have attracted more attention as prognosticators of disease. Certain of the HLA antigens, it turns out, are statistically prevalent among people with particular diseases.

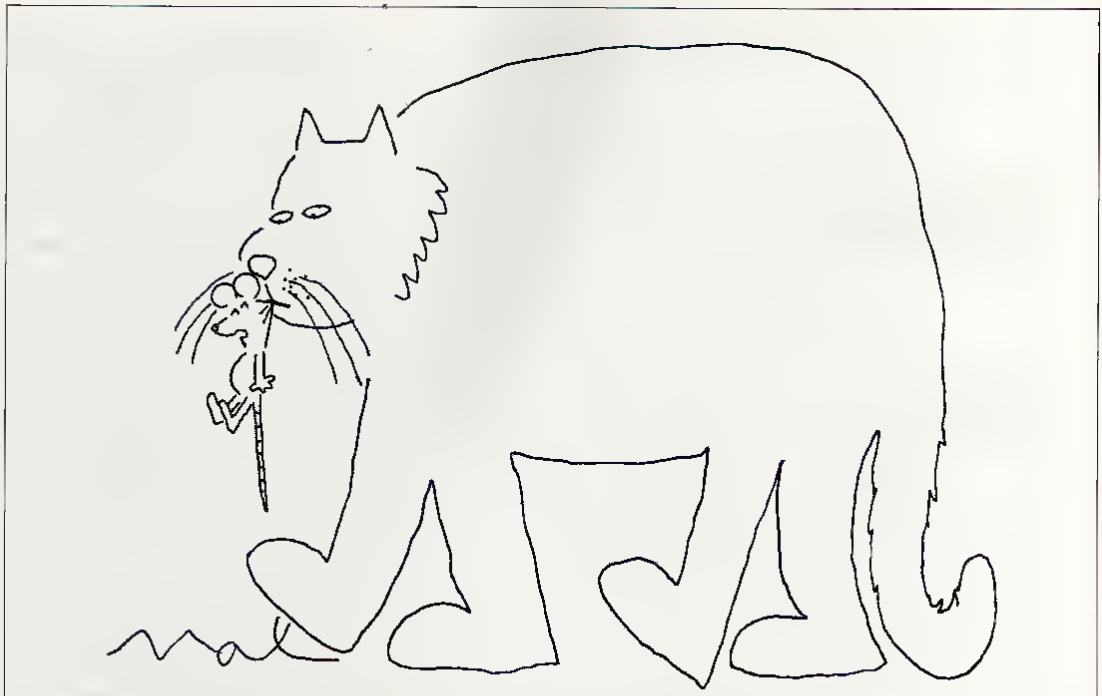
The reason for this correlation is still only poorly understood, but one important clue has come to light. Many HLA antigens have been linked to autoimmune diseases. These disorders arise when the body, in a case of mistaken identity, viciously turns against its own cells as if they were foreign. Molecular mimicry, immunologists theorize, may be the cause of this misdirected assault. An individual's antigens may closely match those found on a pathogenic microbe. When the body mounts an attack against the microbial invader, the result is severe damage to its own tissues. Those autoimmune diseases known to be associated with particular HLA antigens include multiple sclerosis, rheumatoid arthritis, myasthenia gravis (the neuromuscular degenerative disorder that killed Aristotle Onassis), juvenile-onset diabetes, celiac disease (an allergy to wheat gluten), lupus, chronic active hepatitis, and thyrotoxicosis (a disease of the thyroid gland).

Unfortunately these statistical relationships are not as helpful as one would hope. As Stanford University immunologist Hugh McDevitt has pointed out, only a minority of those people who possess the "susceptibility antigen" for a particular disease actually develop the disease. Moreover people with a particular disease do not invariably possess its associated antigen.

Consider the strongest correlation yet discovered between an antigen and disease—the relationship between the antigen known as B27 and ankylosing spondylitis, a chronic arthritis of the lower spine. The symptoms of this disease vary in severity from mild discomfort to a sometimes painful, even deforming condition. But ankylosing spondylitis does not kill anyone. It is treatable and fully compatible with a normal life. The B27 antigen is present in an astonishing 95 percent of people who have ankylosing spondylitis, mostly young men. Yet it has been estimated that *at most* only one out of four males with the B27 antigen will actually develop the disease. This means that 75 percent of the men who possess the B27 antigen will never contract ankylosing spondylitis. So there is little point in screening for its presence, especially since medicine has yet to identify any steps that can be taken to help those who are at risk.

Nevertheless "an editorial in the *British Medical Journal* has suggested that 'eventually, perhaps, boys known to be B27-positive might select physically undemanding jobs that they would be able to keep if they developed ankylosing spondylitis.'" And clinician William W. Gough has exhorted them to "avoid occupations such as driving, dentistry, surgery, and professional athletics, which are likely to place excessive strain on the back." Given the weak predictive power of B27, there is questionable wisdom in advising a child to abandon dreams of becoming a surgeon or of playing football—or even such an everyday pursuit as driving a car.

Still more troubling is an undercurrent in the professional literature suggesting that people may want to use this information not only to make decisions about what careers to pursue but also about which children to have and which to abort. *The Lancet*, a leading medical journal, reports that British parents with ankylosing spondylitis are already beginning to request that their newborns be tissue-typed. And the editorial in the *British Medical Journal* notes



*"Before you eat me, I should warn you that I've been on a diet of carcinogenic additives!"*

that although it "could not be justified clinically there are no insurmountable technical obstacles to identifying B27-positive individuals at birth or even by prenatal diagnosis." So we are faced with the prospect that some people may wish to abort a fetus because there is a very small chance that the child-to-be will eventually develop a mild treatable arthritic disorder.

Of course when a genetic marker portends a grievous illness that cannot be cured, abortion would probably be justifiable to most married couples. Consider the Dw2 antigen, which is found in 72 percent of all multiple-sclerosis patients, but which also occurs in 15 percent of the healthy population. Although an individual's vulnerability to multiple sclerosis is even more difficult to forecast than ankylosing spondylitis, the debilitating, often fatal, course of sclerosis might be considered sufficient grounds to screen for the Dw2 marker. As always, the odds of succumbing will vary from disease to disease. Only rarely will the marker's prognostications be 100 percent accurate. Inevitably some fetuses will be aborted that would have failed to develop the anticipated malady.

That is because the action of genes is often substantially modified by personal circumstances, from the food our mothers ate before we were born (or even conceived) to difficulties attendant on our birth, the air we breathe, the chemicals we are exposed to, even the other genes in our body. The predisposing factors behind most disorders are still largely unknown, but as more are identified, a paradoxical situation will arise. Many genetic diseases will be treated or prevented by purely environmental methods. "Indeed, it is very probable," predicts Harry Harris, an eminent geneticist at the University of Pennsylvania, "that one of the most important social and medical applications of genetic research will lie in the control of the environment, since the more it becomes possible to characterize the genetic constitution of someone precisely, the more likely are we to learn how to modify the environment according to his or her needs."

On paper this sounds as if it might provide the first real hope of preventing an assortment of conditions that are painful, terrifying, expensive, and sometimes fatal. However, "prevention" is a catchall term that may not necessarily involve anything as simple as daily toothbrushing but rather may demand a complete reordering of the way we live.

Suppose, for example, that some genetic idiosyncrasy makes a worker react adversely to a substance encountered on the job. The Environmental Protection Agency tells us that about 63,000 chemicals are manufactured, imported, or processed commercially in the United States, and every year about 500 to 600 new ones are introduced into the marketplace. Some of these compounds are bound to prove harmful to a few highly susceptible people who will then develop cancer or some other serious disease. If markers were developed to identify the endangered worker, he or she might be "protected" by being excluded from that particular job. This has already happened with women of reproductive age who are exposed to lead on the job and who have been given the choice of sterilization or unemployment because of lead's danger during pregnancy.

This prospect has provoked much concern and has resulted in a conference at the Institute of Medicine of the National Academy of Sciences and in a four-part series in the *New York Times*. Labor unions have taken an active role in the discussion, especially the Oil, Chemical and Atomic Workers Union, a leader in focusing attention on occupational health problems.

The principal worry is that genetic tests could become a routine part of preemployment screening. This type of hiring policy might have many alarming repercussions, warns David Brusick, director of the department of genetics and cell biology at the contract research organization Litton-Bionetics, in Kensington, Maryland. The technology, he points out, is currently so limited that preemployment screening could detect only a few types of susceptibilities; this would result in selecting em-

*"Maureen, today at lunch, Hargraves called me a 'Geek.' Have someone find out what he meant."*

ployees on the basis of a small amount of information and could create a caste system predicated on genetic traits alone.

Perhaps the susceptible individual might be forbidden to sue an employer if a health problem did develop, on grounds that, having been informed of his potential risk, he chose voluntarily to ignore the warning. Other economic considerations, such as medical insurance, might also be affected. Finally, preemployment screening would require a massive public education campaign about human variability, its meaning and use. This, Brusick notes, is education of a kind very difficult to achieve.

A curious feature of this discussion is that it has been anticipatory. A recent survey by the Congressional Office of Technology Assessment (OTA) revealed that only a little over 1 percent of the largest U.S. industrial concerns currently test employees for genetic traits.

This may in part reflect the controversy the subject has already provoked. Some industrial employers have abandoned testing they were beginning to use, or they insist that they do not use the information in job placement. But this is the situation mostly because few useful genetic markers have so far been found by scientists. The technology is only at a primitive stage of development. This is not likely to remain the case, however. The OTA report also reveals that almost 15 percent of the companies that replied to the survey planned to employ genetic tests in the future.

In their recent book *Genetic Prophecy: Beyond the Double Helix*, Zsolt Harsanyi and Richard Hutton predict, "It will not be long—perhaps within the next ten years—before any one of us can go to the local clinic, have a blood sample drawn, and receive a computer printout of our susceptibilities to scores of diseases. . . ." That may be too optimistic an assessment of the pace of research and, more important, the rate at which research findings become incorporated into clinical practice. Most physicians know little about genetics and display no interest in applying the field to their practices.

In a general sense, however, Harsanyi and Hutton are probably correct. We can confidently expect that this kind of information will become increasingly important in our own lives and will be commonplace in the lives of our children and grandchildren. We shall become more aware of our genetic vulnerabilities, not only to industrial chemicals, but to drugs, to pollutants of air and water, and to components of our diet. We shall come to understand our individual risks for cancer, for cardiovascular disease, for arthritis and diabetes, and, perhaps most problematic, even for mental disorders and behavioral aberrations.

Although a highly controversial idea a mere decade ago, it is now widely accepted that the two principal groups of so-called mental disorders—the depressive disorders (including manic-depressive psychosis and severe depression itself) and schizophrenia—are strongly influenced by our genes. Interestingly, the studies demonstrating a genetic component in these disorders have also demonstrated unequivocally the influence of the environment on human development. If one member of an identical-twin pair is hospitalized for schizophrenia, there is a 50 percent chance that the other one will be committed for the same reason, despite the fact that the twins possess the same genes.

As Harry Harris suggests, an understanding of the environmental circumstances that trigger the genetic predisposition might ultimately help to avert the horrors of a full-blown psychosis. Consequently, this line of research has proceeded apace. No significant markers for schizophrenia have yet been uncovered, but a number of possibilities have emerged from studies of the depressive disorders. All of these investigations are still at a preliminary stage, but they do offer hope that reliable ways of detecting depression proneness will be available before long.

(We are not speaking here of the transient gloom that descends upon us all when something bad happens, when we lose a job or someone we love, but rather the hopeless misery, sometimes leading to suicide, that comes out of nowhere and usually seems to have no obvious cause.)

As might be expected, one potential marker has emerged from the HLA system. A group of researchers led by geneticist Lowell Weitkamp, of the University of Rochester Medical School, and psychiatrist Harvey Stancer, of the University of Toronto, believe they have located a gene associated with depressive illness that is linked with the HLA antigens. As is the case with other HLA-disease linkages, no one is certain at this point whether the HLA system is directly involved or whether the "depression" gene is simply located near the genes for the HLA system and tends to travel with them. Because Weitkamp, Stancer, and their colleagues employed a novel research method, their findings have been subject to an unusual amount of criticism, and acceptance of their results awaits confirmation by other groups.

It is probable that more than one gene is involved in the development of depressive disorders. A number of biochemical markers that may eventually be found to signal the presence of a particular "depression" gene have also been tentatively identified in the urine, the blood, and even the brains of depressives. None have been universally accepted, though some are being used to guide therapy since they may indicate which mental patients will respond best to various antidepressant drugs. The markers are not being used to forecast disease, but they do offer a way to sort out subtypes after symptoms have already manifested themselves.

David Comings, of the City of Hope Medical Center, in Duarte, California, has

CONTINUED ON PAGE 151


*"Sure, it's absurd, but enrollment's up four hundred percent."*

FICTION

# AUGENBLICK

BY STEVE PERRY

*A doctor's ethics are threatened by political intrigue*

PAINTING BY MICHEL HENRICOT

Thompkins came in and handed me the portable computer terminal with its flat screen. She smiled and moved back so I could see the patient.

The lady looked about forty and was short and obese. She wore the standard plastic exam slip and vaguely resembled a sausage. I looked at her for maybe five seconds, then flashed my professional smile. At the same time I pressed in the familiar code on the flat screen's board. I didn't look at the readout.

"Good morning," I said pleasantly. "If you would disrobe please and have a seat over there." I pointed to the exam table on the wall opposite the clam-shell form of the diagnoster.

The fat woman shed her slip, a portly snake losing its macromolecular skin, and climbed up onto the table. She reaffirmed what I'd learned over the years as a doctor. Almost everybody looks better with clothes on.

I did a physical, though it really wasn't necessary. Sometimes it helps me, but mostly it's for the hands-on effect it makes patients feel like people and not stats. After I finished, I gestured at the diagnoster. "If you would please."

She jiggled over to the machine.

The diagnoster looks like a bloated space suit lying on its back, with hinges along the left side. There is enough room for the top to open and admit a patient without smacking into the dull gray wall, but just barely. Governmental health centers are noted for their efficiency, not their beauty.

Inside the diagnoster the woman lay on her back, arms along her sides, palms up, in anatomical position. I touched a tab and the lid hummed and closed. I touched other controls and the machine went into full operation.

In five minutes a diagnoster will perform some sixty-three tests, mostly noninvasive, from which accurate diagnoses for some nine hundred fourteen major medical conditions can be made. The machine utilizes X-rays, blood and marrow taps, holographic axial scans, ultrasound, bladder and bowel revibes, it does full electronics, ECG, EEG, neurospeed scans, myotlexafion synchs. In five minutes the machine does what it would take five technicians nearly four hours to do manually. At the end of its cycle, the comp-diagnosis is available on any slaved remote flat screen at the lightest touch of a pressure-sensitive tab.

I looked at Thompkins. She shrugged. So I finally glanced down at the history she'd taken. We are all specialists these days. Thompkins, my nurse, took the entire history. I would make the diagnosis; somebody else would do definitive treatment. It's assembly-line medicine, far removed from the old-time family physician who did it all. Most patients don't seem to like it much, but it is efficient.

I read: Married white female, forty-one years, one hundred sixty centimefers, seventy-eight kilos. Chief complaint: right-upper quadrant pain of two days' duration. I glanced up and saw Thompkins smiling at me knowingly.

"You have an idea?"

She nodded. "Acute cholecystitis, probably secondary to cholelithiasis. Gallstones."

I nodded in return. She was a nurse, not an emdee, but she was experienced. "Differential DX?"

"To be safe, rule out MI, pneumonia, perforated ulcer, hepatitis, herpes, and possibly pancreatitis, but the signs and symptoms are classic. Dr. Scates: The lady has gallstones."

I glanced down at the screen. It was a fourth-year med student maxim: for gallstones: Fair, fat female, forty. Obvious, I said. "When you hear the sound of hoofbeats—"

"—you don't look for zebras," Thompkins finished. "Then you agree with my tentative DX?"

It was my turn to smile. "Sorry. Sometimes hoofbeats *do* mean zebras. What we have here is a case of acute pancreatitis."

She tilted her head slightly to one side and stared at me. "You want to bet?"

"Do you?"

She held the stare for a few more seconds, then shook her head and laughed. "Not a chance."

She could see it wasn't a wild guess. I *knew*, and she knew I knew.

*Augenblick*, they call it. The ability to make a diagnosis in the blink of an eye, to look at a patient and, without a question or a touch, *know* what is wrong. It isn't psychic, but a combination of sensing body language and subclinical signs and somehow putting them together unconsciously for what amounts to a flash of knowledge. Idiot savant medicine. I've always had it, to a degree. Nearly all doctors do. But after twenty years as a PD—Pure Diagnostician—the ability has grown. I never know when it will manifest. I have no conscious control over it, but it happens. I don't talk about it much, but some of my colleagues tend to look at me funny when I make a diagnosis before the machine. Like Thompkins was looking at me then.

The diagnoster chimed, to show it was done. As the lid opened, I tabbed the readout on the flat screen's keys. Thompkins helped the lady from the machine as I watched the results crawl up the screen and vanish into infinity. Finally the bottom line appeared, the computer's diagnosis:

ACUTE PANCREATITIS.

PROBABILITY: 94.565 PERCENT.

I turned the flat screen around so Thompkins could see it while the patient stretched her way back into the exam slip. Thompkins smiled thinly at me.

"Would you take this lady over to Internal Medicine, Shelley? See if Dave Best is on."

"Haven't you heard? Dr. Best was transferred uplevels yesterday. To Research."

Dave? I'd had lunch with him a week ago. He hadn't said anything about leaving IM. He was too good a doctor to be wasting his clinical skill in Research. Of course there were a lot of perks, extra methanol chits, more money, but it still bothered me that Dave had sold out. I wouldn't leave my practice to become a tube washer or stat stacker no matter what kind of money they offered.

"All right. Whoever is seeing people this morning. They're all good."

I saw eighteen patients before noon, with ailments ranging from viral URIs to fungal infections. Each could be cured by the proper specialist; all I had to do was make certain each was routed to the right one.

Thompkins led an old man into the room just before noon, a white-haired gnome of seventy or so. When I got a good look at him, my breath caught and held, and a cold wind from some far place wrapped itself around me.

I did the physical and ran the diagnoster, but it wasn't necessary. I knew what the old man had. Bern's neuropathy.

Bern's neuropathy, a freak radiation disease, only ninety recorded cases of it. I've seen four in my twenty-four years of medicine, counting this one. The etiology is thought to be due to a radiation leak at a nuclear conversion plant in Arizona some thirty years earlier. Each of the known sufferers had been in the immediate vicinity during the leak.

The prognosis is death. The disease affects the peripheral nerves, deteriorating the sheath, scattering the impulses in strange ways. Neuromuscular systems fail dramatically at the disease's peak. There are spasms, paralysis, sometimes alternating in a kind of tetany-palsy that makes the victim look like a string puppet controlled by a madman. None of the mylestat bacteria used to cure multiple sclerosis are effective. Treatment is at best palliative, nothing more.

Early in the course of the disease there are slight, jerky motions which are characteristic. A pause-move-pause cycle can be seen by a careful observer looking for it. The course is highly varied; it can take two months to kill or two years or two decades or longer.

The old man was inside the machine.

*"She died before we could light the lasers properly, the glass still clenched in her bloody hand. She died, her mind alert, imprisoned in her rebel body, helpless."*

and I was alone in the exam room, listening to the faint sounds of the diagnoster: the clicks, the buzzes, the soft hums. The air smelled antiseptic, but stale. I'd seen three other cases of Bern's, and it had been my *Augenblick* that had gotten them all. It's interesting, my talent. Sometimes it can work with holoprojection images, flat films or tapes; even a particularly accurate painting can trigger it. Probably not many people know the lady called Mona Lisa had high blood pressure.

It is my gift and my curse, for sometimes it tells me things I don't want to know, at least not in that sudden, undeniable manner. It was *Augenblick* that showed me that the President of the United States, aged sixty-four and from Phoenix, Arizona, also had Bern's neuropathy. No doubt an otherwise well-kept secret.

Then there is the third case, my first, actually. I discovered it during my internship in Arizona, one of my first *Augenblicks*. I knew that patient intimately.

I see him every time I look into a mirror.

The diagnoster rang, sounding too loud in the quiet room. I started to jerk around at the sound, and there was the slightest hesitation in my movement. The characteristic move-pause-move of fatal radiation neuropathy.

The horror settled on me again as I remembered my second year of residency. One of the first cases of Bern's disease was on my medical rotation. A young woman of thirty-five, mother of three, had it. I'd watched her go down, helpless to alter her descent. She progressed rapidly from a slight hesitation in her movements to a jerky, twisty lurch in every motion. But she was tough. She refused help as much as she could, determined to beat it on her own. I watched her try to reach for a glass of water, watched her try and fail, try and fail, then finally succeed—only to spill the liquid and shatter the glass as her forearm muscles locked, her hand into an uncontrolled spasm. I tried to pry her fingers from the splintered glass in her flesh, but I didn't have the strength to open her hand. Intravenous muscle relaxants failed. So we set up for surgery. She died before we could light the lasers properly, the glass still clenched in her bloody hand. She died, her mind alert, imprisoned in her rebel body, helpless.

More than anything else, I didn't want to die that way.

A few days later I ran into Dave Best in the hall next to the cafeteria.

"Hey, Dave."

He turned. Dave is tall and thin, mostly bald, and he always reminds me of an ostrich in a lab coat.

"Rick. How is it going?"

"I should ask *you* that. I heard you were transferred to the Locked Room. Uplevels. Congratulations are in order, I suppose. Only with you gone, who is going to take care of my belly crocks from now on."

Best smiled. "It did seem to come down pretty fast. They called, and it was the old we-need-you-yesterday routine. You know how it goes."

I nodded. *Yeah. They waved the money, and you went running.* "Got you doing something useful, I hope." It wasn't really a question. One wasn't supposed to probe. Research people too deeply; such was considered bad form.

"Right. Looking for a cure for baldness." He rubbed at his bare scalp and chuckled. He seemed a little antsy. "Look, I've got to hit. Rick. Let's get together for lunch sometime soon."

"Sure. Dave. Take it easy."

As he left, I felt a small twinge of discomfort. He seemed different somehow. I put it down to his being transferred, having to adjust to his new job.

A week later my morning started with a five-year-old girl complaining of joint pain, fever and general malaise. Her mother thought it was probably the flu.

"Hi. I'm Dr. Scates. I hear you've been feeling sick."

"Uh-huh." She seemed very small and frail, perched in the middle of the big black-plastic exam table. She had long, blond hair and green eyes and was obviously uncomfortable, but trying to be brave.

*If Sondra and I had stayed together, we could have had one her age by now.* I shook the thought. It snakes had legs, they'd be lizards.

"Well, maybe I can make you better."

"Will it hurt?"

"No, honey, it won't hurt. I'm just going to look at you and then let you go for a ride in the spaceship." I nodded toward the diagnoster.

Her eyes widened. "Really?"

Really. The designers of the diagnostic machinery had planned for children. Built into the top of the device is a holojector that features flashing lights and a holo of a flight to the moon, along with animated characters and a short story. Kids love it. Even some of the adults ask for it to be run when they're inside.

I finished the physical and led the child, Susan, to the diagnoster. After she climbed inside, I read her history. I glanced at Thompkins, but she shook her head. There had been no touch of *Augenblick* on this one, so I had to depend on the history, my exam, and the diagnoster. I had an idea before the machine opened and she climbed out, but I wasn't sure.

When the comp-diag lit on my screen, I froze my face into a careful neutrality. My professional facade carried me through talking to the girl, through putting a stat appointment with Oncology through. I watched Thompkins lead them from the room and watched the door slide shut soundlessly on its plastic bearings.

Then I slammed the exam table with my fist. The foam absorbed the blow easily, but not my anger.

"Take me to your Department of Social Services."

'Damn!

The little girl had AML—acute myeloblastic leukemia. One of the few neoplastic diseases we couldn't cure. With treatment, under the best of conditions, her particular variety would let her live a year. Without treatment, that five-year-old child would be dead in half that time. And there wasn't a damned thing I could do to stop it.

I shook my head, took a couple of steps and kicked the base of the diagnoster. *Sure, Scates, blame it on the machine.*

There is supposed to be something called professional detachment in this job. Either you develop it or you don't survive. If you hurt for them all, it will cripple you; you'll burn out. That's what they teach you in school: how to build a hard, protective shell, an armored hide. But now and again the shell cracks under the pressure and lets in a stray feeling. The sense of helplessness leaks inside and rolls over you; you continue to shake your ju-ju bags and mumble the tired words, you call on the Great Spirits, but you know it's all a sham. You can keep old men alive, men who have shot their livers, their stomachs, their sex organs with too much booze, too many drugs, too much everything. You can keep them going, with artificial parts and transplants, high-tech surgery, and sonics and do miracles. Then for certain things, certain people, there comes a wall—a wall that cannot be climbed or dug under or walked around. You come to your limits and stand there, empty-handed, facing a sneering killer, and you know you can't beat him.

*Damn it!*

I rubbed at my eyes. Sometime in my past, I'd made the big decision to become a doctor. I wanted to help people, to make them well. I thought of myself as a humanist, a physician, a healer. If I could wave my hand and wipe out all disease, I would, I believe that. Ah, Susan—

From some dark compartment in my mind a malevolent little voice snickered. *Quite the altruist, aren't we?*

I blinked, felt the gathering tears pause. *What?*

*What about the other reasons you went into medicine? What about your own fears? You were always afraid of being sick yourself, Scates, weren't you? Didn't you think a doctor would have an edge? Didn't you think you'd be in the front, know what to do, have some secret knowledge? Classic case of Physician, heal thyself, wasn't it?*

Before I could deny it, the thought continued.

*Isn't there some irony in having a disease you can't do anything about? Are you crying for the little girl, Scates?*

*Or are you crying for yourself?*

I was in the shower that night when it finally came to me. A thought from my subconscious suddenly surfaced.

*There was nothing wrong with Dave Best.*

The water continued to wash the cleaner from my body, but I was lost in thought. There had been nothing wrong with Dave when I'd seen him last, and *that* was wrong.

I'd known Dave nearly ten years, since being assigned to the Houston Clinic, mostly on a passing social level. Even so, I'd seen him often enough to be convinced of an early *Augenblick*. He'd inspired. Dave had a case of chronic splenic neufropenia. I couldn't tell how much trouble it caused him, but he had it.

I flicked the shower control with my knee and turned the water off. I started the dryer; warm air surrounded me. One of the virtues of scientific training is grounding in basic logic. The problem with logic, though, is that you need truthful syllogisms to obtain valid conclusions. Dave had a chronic disease, that I was sure of, but when I saw him last, he didn't seem to have it.

I considered the possibilities. Remission? Possible, of course, even in a case of long standing. Unlikely, but possible. Or I could simply be mistaken. Maybe he still had it, only I had just missed it that particular day.

The blower clicked off. Of the two choices, Occam's razor said go with the latter. Easy enough. Dave wasn't my patient. I hadn't done a PE or a diag. I was mistaken.

I padded across the turf carpet and sat

on my bed. It was the little girl, Susan. I'd been upset about her all day. It was making my thinking murky. But my gut feeling still said something was wrong.

I watched Best thread his way through the crowded cafeteria. It was worth a few minutes extra to satisfy my curiosity, and I watched him very carefully. I saw him stop and speak to Pete King, the stubby ex-chief of Neuro. Another detector. King had left his patients and gone uplevels to Research a few days before Best.

I shifted into my doctor mode and looked at Best as I would at a patient. Except for a hand-sized patch of dermatitis on his bald head, he looked perfectly healthy. He laughed at something King said and started in my general direction.

"Stay out in the sun too long, Dave?"

He stopped and glanced down at me. "Beg pardon?"

I pointed at his head.

"Oh, that? A new shampoo. Looks as if I'm allergic to it."

"I thought maybe you were trying one of your top-secret baldness nostrums on it." I laughed.

He looked as if he'd been punched in the solar plexus. He laughed, too, but the sound seemed forced. "No. Just bad shampoo. That's all."

He started to walk away, and I stood. I looked at the patch on his head. The scalp was reddened and flaky, as it would be in a hypersensitive reaction. Nothing unusual. There was a small triangle of skin close to the crown, where the scalp seemed normal. There was even a stubble of hair growing. New hair, it looked like.

Dave had been bald there for years.

I thought about it on the way back to my office. A puzzle, and I'd always liked puzzles. It probably had to do with Dave's new job, his nervousness, his abrupt manner, and it was none of my business. Still, it grated on me. I was about to dismiss the whole thing when it came to me what Dave's head reminded me of: depil-cream dermatitis. That usually showed up on kids trying their first shave, from using too much depil on sensitive skin.

That made no sense. Why would Dave Best, who was going bald and very nearly there, be using depil cream on his head?

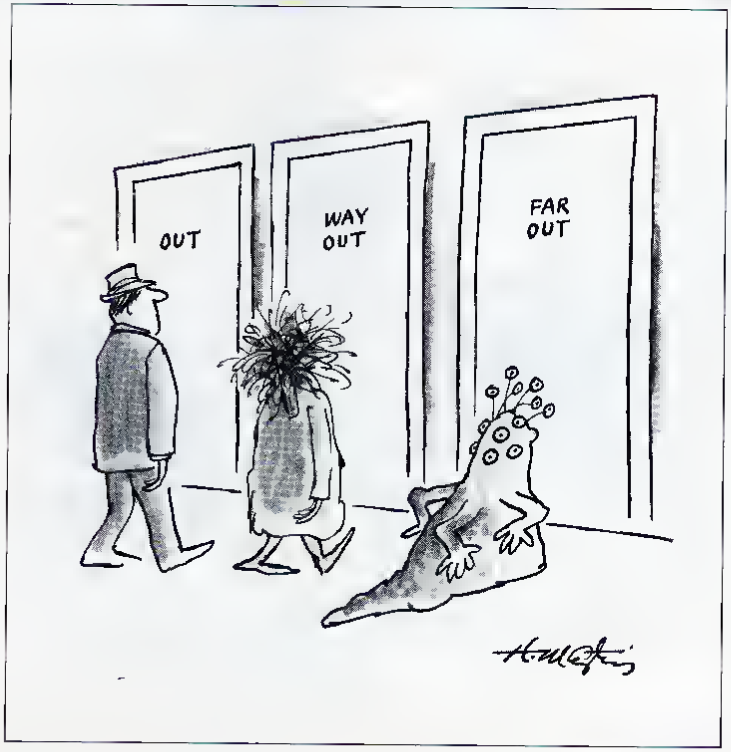
Occam's razor left me no choice on that one: to get rid of the hair. The *new* hair. Only he'd missed a spot near his crown.

I thought about that for a minute. Could the joke be true? Had I touched on a secret? Was it possible that Dave and the rest of the Locked Room crowd were working on a cure for baldness?

That thought was so ridiculous, I laughed aloud.

Thompkins looked up from her desk. "Private joke?"

I said, "But there was something going on that wasn't funny. Dave Best, according to my hands-off talent of instant diagnosis, was a well man.




The President of the United States was giving his semiannual talk on the economy, and I had my holojector on so that I could see him. I didn't care much for his politics, but I wanted to see the progress of our common illness.

The three-dimensional holoproj stood behind a ghostly lectern in my living room and grinned at the world. The President spread his arms in that theatrical gesture that seemed to endear him to the voters as he made a particular point. There was always a little pause in the middle—everybody thought it was for effect, but I knew better—only this time the gesture was sweeping and smooth, with no hesitation whatsoever.

That cold wind from a far place blew through my being again. I felt a small, sharp jolt.

All of the subclinical signs that said Bern's neuropathy under my *Augenblick* consciousness were gone. Either I had lost my talent, or the President no longer had our incurable and terminal illness.

I stared at the picture. Had I lost it? Was my own illness affecting me in some manner even worse than the terrible atrophy of the peripheral nervous system? Would my brain degenerate as well?

*Please, no.*

It was a long night. I finally ended up in a deeply drugged slumber, using a wall of oral hypnotics to keep the fear outside. The dreams somehow slipped past, and I was afraid to face my patients in the morning, afraid of what I might not be able to see.

There came an ulcer, a malfunctioning cardiac valve, an ankle sprain, a bacterial sinusitis. Four people, four sicknesses. I was never so glad to see human malfunctions before as when I saw those. I knew what was wrong with two of them before I touched them, before a word was spoken. My *Augenblick* was there, as strong as ever. I hadn't lost it. My mind was still whole.

For a brief time the relief kept away the logical processes that waited in the wings of my mind. Then, if I still had all my skills and talents, what about the President? Either he'd had a miraculous remission—the only one known for Bern's—or he still had the disease and I missed it. But once I saw something under *Augenblick*, I could always see it in the same patient again. It was like certain kinds of optical illusions: once you've seen them, you could see them no other way.

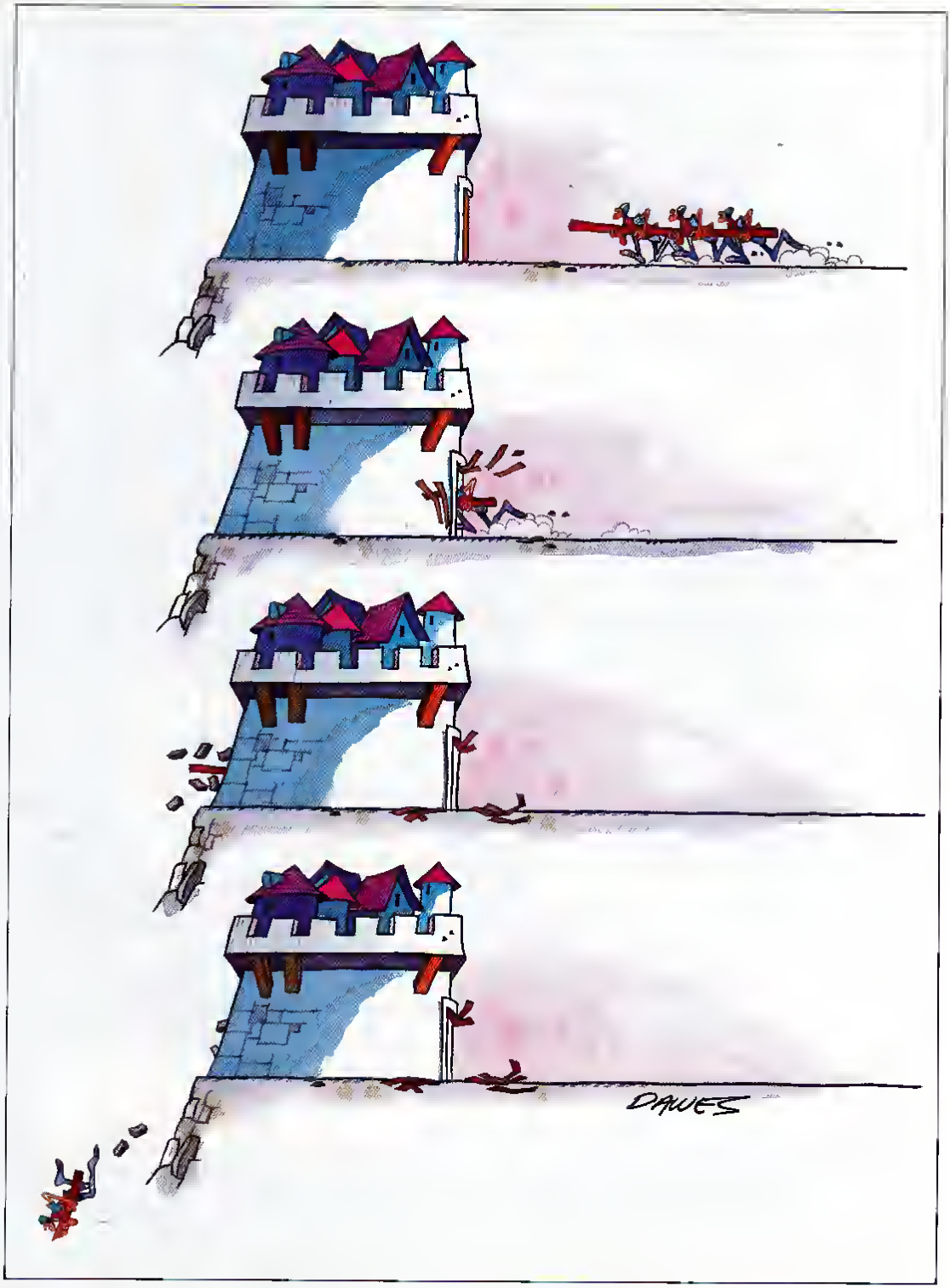
So the President of the United States no longer shared our illness.

And Dave Best had lost *his* disease.

How? Both conditions were chronic. Dave might have had his spleen surgically removed, but no laser scalpel could correct the President's rotten nerve tissue.

And as in some puzzles, there appeared to be a kind of link. I had no rational reason for thinking that, just a feeling, but it was a strong one.

I needed more information. I didn't have access to presidential records, but I could


DAWES

get at Dave's. It was standard procedure to put a new diagnoster run on file when changing departments in government service. All I had to do was punch in the proper code and retrieve Dave's file from the main computer. It wasn't particularly ethical to spy on a colleague, but it was valid if considered medically necessary.

I needed it for my peace of mind. *My* mental health.

I sat at my regulation permaplastic desk in my worn form chair and punched at the remote flat screen.

BEST A DAVID MEDICAL HX SPECIFICS?

The last annual PE ought to do it, along with the recent posttransfer diag. I punched in the request.

The computer began to line out the exam. I blinked and triggered my speed-reading set. The words sped by. Yes. Chronic splenic neutropenia. I waited for the current diagnoster report. It should be coming up—

HOLD. FURTHER SEQUENCING IS UNAVAILABLE WITHOUT SECURITY CLEARANCE BETA ONE. YOUR NUMBER?

If the readout had suddenly turned into a big spider and scurried from the screen, I would have been less startled. *B-1?* That was big-time, four notches above mine top-security stuff. Dave Best's medical exam was classified material. I had to find out the reason for that, of course.

The woman left, hurrying toward the third-floor lavatory. She was fifty, a hyperkinetic type with exophthalmic eyes, and she passed me without giving me a second glance. I knew she'd be spending a lot of time in the bathroom this morning. The cc of fairly potent diuretic I'd dropped into her morning orange juice at the cafeteria earlier would guarantee it.

This was dangerous, a fool's game. I kept telling myself, but I was too caught up in the puzzle to back off. The administrator was out of town, and I knew her secretary would have a copy of her boss's code book. With the woman in the bathroom, the office would be empty.

Inside her office, I kept hearing phantom footsteps, kept seeing shocked stares and pointing fingers as I went through the desk. I could see how people could become addicted to adrenaline, to the wired-high feeling. *Come on, come on!*

I found the code book, copied the number, and left quickly. As I passed the lavatory, the secretary emerged, looking drained. I felt for her. I knew the same sense of relief, I figured.

I found myself holding my breath, but the comp couldn't see me, only the code of the administrator I fed it.

The entry was dated a few days after Dave's transfer. The stats were dry medical jargon, without any explanation, but I didn't need any. Dave still had his spleen, and it was perfectly healthy.

There could be a lot of explanations, but I kept coming back to one in particular, one I wanted to believe. I kept tossing objections at it, but it didn't want to go away.

Dr. Scates? It was Thompkins. "Dr. Best is on the phone for you."

My rush of adrenaline came back. Epinephrinemia washed over me like a high tide.

"Richard, I think maybe it would be a good idea if we got together today and had a talk."

My mouth went dry. He *knew!*

Suddenly I felt stupid. Of course he knew. There must have been a comp-cop riding his file. And I'd blundered in using my own name first and then a stolen code, a code that belonged to somebody who couldn't possibly have used it on a local terminal. It was a stupid error, to be caught by an idiot program.

"Sure, Dave. Anytime."

"Five o'clock. My office. You'll be cleared."

"Okay, Dave. See you then."

"You want to tell me why you've been checking my medical HX, Rick?"

Right to the point. I swallowed. I hadn't had much of a chance to think about it before he called, but enough time to worry

about it since I might be in trouble. On the other hand, I'd gone to a lot of trouble to get this far.

"You weren't kidding about the cure for baldness, were you?"

He stared at me, cranelike. "What?"

"That's only the side effect, though, isn't it?" I took a deep breath. "You've created an adaptogenic, haven't you? A good one. The best ever."

He sucked in a deep breath of his own. "Jesus! How did you—" He shut up, looked around the room, then back at me.

I felt a sudden pseudoelectrical rush. *I was right!*

He realized the damage was done. "How did you find out?"

"My *Augenblick*. One day your bad spleen was gone, poof, just like that. And you started to grow hair. That's depil-cream dermatitis, isn't it?"

"That's it? You got it from *that*?"

I shook my head. "Did you know that the President of the United States once had Bern's neuropathy? *Had*?"

He nodded slowly. "A fluke. Only somebody with your talent could have figured it out. A billion-to-one shot."

We stared at each other for what seemed a long time. Finally he stood and moved from behind his expanse of desk. "Come on."

I followed him down a brightly lit hall. We stopped at a hand plate next to a stainless steel door. Best palmed the lock, and the door slid open. I followed him into a huge biolab. Cages of long-haired hamsters lined one wall, hundreds of them. In the center of the room stood plastiglass chimp stalls, containing a dozen of the simians. There were stainless sinks along the walls, each with a cast aluminum disposal the size and shape of a small barrel, for grinding the bodies of discarded lab animals. Pyrex beakers and light burners and assorted racks of lab paraphernalia were ordered neatly about the tables and biocabinets. Research at its finest. Dave and I were the only people in the big room.

Best walked to a cold case and removed a pressurized sim's jar half-filled with pale blue liquid. He held it in front of me so that I could see it clearly. I stared at the translucent fluid. The adaptogenic. The goal of medicine since before Hippocrates: an elixir, a tonic, a substance that could somehow trigger the recipient's body into a state of repair like never before. Not a specific treatment for any illness, but a broad-spectrum aid, almost a cure-all, an adaptogenic.

"What are you going to do about this, Rick?"

I pulled my stare away from the pearly blue drug and focused on Best. "Do? Me? Nothing. It was a puzzle. I just had to find out, that's all. I won't say anything until you decide to go ahead and publish."

He put the liquid back into the cold case. I felt a draft of cool air envelop me as he slid the door open and shut. "It might be awhile before we can go public. Rick. There are still some nasty side effects, some bugs to work out."

I glanced at the wall covered with hamster pens, then back at him. "*You* took it. And the President did. That sounds pretty safe to me."

"The President. That was his idea. He's got spies in Medical."

Something was wrong. "What are you trying to tell me, Dave?"

He turned and walked toward the chimpanzees. One of them saw him and began to pound on the inside of the clear plastic with one fist.

"Only that we aren't ready for full-scale testing yet. There are problems with the compound. Why else would they have needed me? Or you?

"Me? I don't want into Research, no way. You know me better than that."

"You could be a big help on this, Rick."

I couldn't see how I could help, not as a PD. But I heard something in his voice, something almost desperate, as if he were begging me to believe him. I thought about it, and then it hit me. I stared at him. "It's political, isn't it?"

"We've got FDA controls, Rick, you know how—"

"Political," I said, as if he hadn't spoken.

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*"Right here on the resume, sir, is where I'm trying to say that I'm functionally illiterate."*

*There are those among us who are serenely confident they are more than a match for the smart machine. Meet the*

# COMPUTER KIDS

BY DOUG GARR

PHOTOGRAPHS BY MALCOLM KIRK

*For Greg Trautman and his friends (below) the computer has become a part of their childhood*

Enter a typical middle-class teen-ager's bedroom with the obligatory rock and roll posters, in this case Led Zeppelin and the Kinks adorning the wall. Greg Trautman (previous page), fifteen with thick eyeglasses and braces on his teeth, is a precocious-looking talkative New York adolescent. "Still programming in BASIC?" he playfully asks his friend Sujee DeSilva who is busy ordering his Atari 800 to cough up the modest game program he wrote. "We've had the Atari for only about two months. So we're just getting into the intricacies of it," Greg says, as if the new machine were partly his own. Trautman is clearly envious of his friend's recent acquisition, mainly because he must be content with his year-old Radio Shack TRS-80, a less costly home computer with a much smaller memory. The Atari has four times the memory, high-resolution color graphics, and a greater potential for complex programs. Jason Bucky, fifteen, is jealous too. He also has a TRS-80, but he's pining for a disk drive, a device that would let him eliminate the slower, more cumbersome method of storing his programs on cassette tapes.

Later Carey David, also fifteen, arrives. Greg acts positively reverential. "He's the genius," Greg remarks. Carey looks like a street-smart kid right off the set of *Welcome Back, Kotter*, but a few moments after he slips his cytogenetics program into the Atari, it is apparent that he is serious about computers.

A bunch of jumbled letters appear on the video display terminal, which Carey says represent amino acids, or chains of protein molecules. "A geneticist can use this program to manipulate the DNA chain in order to change the molecules and get different organisms," Carey says. "Like insulin." To demonstrate, he types a little more on the Atari keyboard. In 1981, while a ninth grader, Carey took five months to write this program. It won first place in the Queens Borough Science Fair. His current project is a program that will let his junior high school work out the complex administrative tangle of class scheduling.

The interests of this small group of computer devotees are typical of what has happened with computer technology among the young. Ten years ago the only contact the average person might have had with a computer was some basic math done on a pocket calculator or a few games of Pong in a bar. Today the computer has entered the mainstream of American life as a serious and powerful learning tool. And nowhere is the impact of this change more evident than among the school-age kids of today, the first true computer generation.

Already the computer plays a crucial role in the lives of thousands of kids, both as the center of an all-consuming hobby for youngsters like Greg Trautman and his friends and as a classroom fixture. According to the National Center for Education Statistics, by 1980 52,000 computers were already in use in the nation's elementary and secondary schools, and by the end of 1981 an estimated 40,000 more machines were installed. Even some recreational activities have become computer-centered. A slew of summer computer camps, where kids do everything from playing softball to programming in BASIC (a primary computer language), are now operating across the country, from Moodus, Connecticut, to Zaca Lake, California.

All indications are that the proliferation of machines is only just beginning. The Tandy Corporation, which owns Radio Shack, has already awarded $500,000 in computers and equipment to schools all over the country under its Educational Grants Program. Since the fall of 1979 the Apple computer company has donated nearly $1 million worth of equipment to schools under a similar program. Even the federal government is beginning to see the value of computer education. As the result of an Apple Corporation offer to donate one computer to every elementary, junior high, and high school in the country—a total of about 80,000 computers—a group of California congressmen introduced the Technology Education Act, which would give high-tech corporations larger tax credits for such contributions. The National Science Foundation has also been asking computer firms to donate equipment to high schools under its Development in Science Education Program. And to train students to use these machines, the Educational Testing Service, of Princeton, New Jersey (the organization that develops and administers the Scholastic Aptitude Test), recently announced that by 1984 it will have standardized its advanced curriculum in computer science.

In the meantime schools are not waiting for the trainers and equipment to arrive. They have already begun to revamp their curricula at an astonishing rate, so much so that by the 1990s it will be all but impossible for a student to pass through high school without having had some firsthand experience in using a computer. These changes are not just happening in well-to-do private schools, where this might be expected, but in public schools, too.

A good example is Francis Lewis High School, part of the New York City public school system, in Queens. Because of the foresight of its principal, Melvin Serisky, it is already serving as the model for the rest of the system. When the school opened in 1960, Serisky was a math teacher. His involvement with computers be-

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# GENIUS HUNTING

*The saga of one very wealthy foundation's cautious search for the Einsteins of the 21st century*

BY JAMES RESTON, JR

Joseph Taylor, a Princeton radio astronomer and one of the preeminent experts on pulsars, had been asleep for over an hour late one night last November. Suddenly the phone rang. On the other end, a Mr. Roderick MacArthur identified himself. Did Taylor ever hear of the MacArthur Foundation? he asked.

It was a reasonable enough question to ask. Last year in Chicago the billion-dollar John D. and Catherine MacArthur Foundation had suddenly burst upon the quiet scene of American philanthropy with enough fanfare to turn the heads of a whole Nobel Prize committee.

The foundation's concept was both revolutionary and old-fashioned: to bet on certain individuals of proven creative talent, not simply by honoring them, as the Swedish Parliament does, but by supporting them financially for five years with no obligations whatever. In freeing these brilliant few from workaday projects, so the MacArthur notion runs, the Prize Fellows Program could enable them to make astounding breakthroughs for mankind that might not otherwise be achieved.

"I lied and said I'd heard of them," Taylor recalled. "Then, as MacArthur talked, obviously enjoying himself, I did remember having read something about it and thinking the foundation was a bit on the wacko side, around the bend. As he was telling me I had received the prize, I thought, Now whom do I know well enough who would try a joke like this on me?"

If the first prizewinners, 41 in all, have been mystified by their good fortune, the world at large has been increasingly skeptical of MacArthur's well-meaning largess. More than a year after its grants were announced, the foundation is still struggling for academic respectability. The victim of its own hyperbole, secrecy, and timid first selections, it has become something of an American curiosity as well as the butt of *New Yorker* cartoons and tongue-in-cheek reportage. It is seen, perhaps unfairly, as having made a hubristic attempt not to support but merely to buy up creativity.

Before delving into how the prizes have affected the life and career of some of its first recipients, it might be helpful to look at the somewhat tortured birth of this unique Prize Fellows Program.

The public's imagination has been caught by two aspects of the MacArthur program: its immense grants (with sums ranging from $120,000 to $300,000 for its honored recipients, the prize dwarfs any other private or government

PHOTOGRAPH BY MANFRED KAGE

funding) and the 'genius' label that has become attached to the MacArthur Foundation's Prize Fellows Program.

The MacArthur Foundation made its first mistake in the soaring rhetoric it used when it launched the program. All that was missing were the heralds and the brocade when the foundation's president, William Corbally, intoned, "Historically the great breakthroughs of civilization most often have come through individuals engaged in the dedicated, uncompromising pursuit of knowledge, striving to reach beyond the known, beyond the accomplished. The search [of this organization] is for people at the frontiers of knowledge, with the hope that, free of pressures and distractions, they will cross the frontiers."

With that clarion call, the astonishing details were unveiled. The foundation would bless a select number of gifted individuals with anywhere from $24,000 to $60,000 a year, depending on their age, to help them pursue, for five years, any line of activity they fancied. The fellows were free to accelerate endeavors already in progress or even switch fields altogether. No accounting to the foundation would be required. The money was not intended to be reimbursed. Immediately the program was saddled with the epithet 'genius awards,' a label the foundation is desperately trying to shed.

Along with its lofty promulgation and its unenviable label, the foundation also got itself into deeper trouble by making much of the "high risk" element in its experiment and the "boldness" of the concept. Its search, the MacArthur hierarchy said, was to reach beyond genius, to those mavericks of American science, letters, and the arts who might not always be inhibited.

But the 1981 roster of 41 prize fellows indicates not risk or boldness, but conservatism, caution, and a kind of public-relations slickness. Taken together, the group is certainly distinguished. It is festooned with men who are household names in their field, if not in the arena of public recognition: poet Robert Penn Warren, child psychologist Robert Coles, and paleontologist Stephen Jay Gould. The least-known fellows among the 41 selected are, for the most part, highly respected and well-situated professionals who have had little difficulty in obtaining funds for their projects. Although the selection process is secret, the fact that 23 of the fellows hail from Ivy League institutions also raises suspicions of the Old Boy network in force.

The present year's list of winners, announced this past summer, is a little more eclectic. It includes such people as Conlon Nancarrow, an expatriate composer who has written several works for player piano, and Alfonso Ortiz, a full-blooded Tewa Indian active in Indian affairs and a professor of anthropology at the University of New Mexico. Still, there is a strong bias toward the status quo. Nine of the 19 recipients are affiliated with prestigious universities such as Chicago and Stanford.

MacArthur officials now say defensively that those first choices were made merely to illustrate the *kinds* of individuals the foundation is going after. One board member refers to them as "markers" or "standards of reference."

The inspiration for the program came from Dr. George Burch, a Louisiana cardiologist who just happened to have the lawyer for the MacArthur trust as a patient. In a paper published in the *American Heart Journal* in 1976, Dr. Burch had roundly criticized private philanthropy in the United States as restricting, rather than advancing, breakthrough research. The main problem Burch asserted was the procedures that had to be followed when asking for money from a foundation. In effect, the creative scientist had to define in his grant request the discovery he would make even before he had made it. Foundations must gamble on creative thinkers, Burch argued, "and leave them alone in peace to think, observe, and study without having to spend valuable time giving account of themselves."

Then, in January 1978, at the age of eighty, John D. MacArthur died, at the time one of five billionaires in this country (the four others being John Paul Getty, Howard Hughes, Howard L. Hunt, and Daniel Ludwig). MacArthur had built his company, Bankers Life and Casualty, into a corporate giant after purchasing the near-bankrupt firm with a borrowed $2,500 in 1935. Born to an impoverished family in eastern Pennsylvania, MacArthur fitted the classic mold of the crusty American industrialist. He dressed plainly, enjoyed being mistaken for a bellboy or handyman, and eschewed the trappings of wealth. Toward the end of his life, he ran his business from a back table in the coffee shop of a Palm Beach hotel he owned.

In his will, the tycoon included no specific stipulations as to how the gigantic holdings of Bankers Life were to be spent. To a colleague, the old man had said simply, "I'll do what I know best — making money. You fellows will have to learn how to spend it."

After his death, the problem of what to do about spending the fortune fell to a board, obligated under the provisions of the 1969 Tax Reform Act to begin disbursing 5 percent of its assets each year. The key member of the board of directors was Roderick MacArthur, John MacArthur's son. This in itself had an element of irony. Throughout his adult life, the younger MacArthur had a stormy relationship with his father. After spending four years as a newspaperman during World War II, he joined the family business. It didn't work out. Tension between father and son was electrical, and the son was eventually fired. Undaunted, he founded his own business, the Bradford Exchange, which marketed collector's plates, and which he built into his own multimillion-dollar enterprise. Now


"Testing, one billion, two billion, three billion..."

white-haired and crusty himself, Roderick has his father's tendency to puncture pomposity and the same determination to encourage the unconventional.

When Roderick MacArthur decided he wanted to adopt Burch's idea of "betting" on creative individuals, the board backed him up. In 1979 and 1980 he consulted with many inside the foundation and in scientific fields, among them Carl Kaysen, the former head of Princeton's Institute for Advanced Study, which had lured Albert Einstein to the United States from Europe in 1933. But if the Einstein example is at all relevant to the MacArthur experiment, it should be noted that Einstein's great discovery of the theory of relativity was made not amid the quiet setting of Princeton but 27 years earlier, while he struggled as a civil servant in a Swiss patent office.

MacArthur was convinced that he was on to a critical flaw in philanthropic funding. Scientists had repeatedly told him that the procedures for soliciting research money from foundations and from the government not only discouraged breakthrough research but, more seriously, encouraged dishonesty.

"The pattern had developed whereby one does the work and keeps it quiet, then submits a grant proposal to discover what he already knows," he explained. "With money thus obtained, the energy of the creative scientist can then be directed toward the next area of original research."

At the National Science Foundation (NSF), for example, it is generally recognized that flamboyant proposals for bold strokes will receive no support. This fosters what an ex-NSF division head describes as the "B+ or A− proposal in which a scientist will stress the small step forward, one that barely inches ahead of his previous work.

Within this staid climate, the MacArthur idea provided a jolt of energy.

I began my investigation into how money affects genius at Princeton University's Jadwin Hall, an impressive dark-brick modern structure built around an expansive courtyard and appointed with a striking sculpture. In one commodious, well-organized office overlooking the courtyard I found Dr. Taylor, a forty-year-old radio astronomer who a few months before had received notification of his MacArthur fellowship. Taylor seemed the perfect choice. As a young researcher in a science only a dozen years old, he had already considerable achievements to his credit. The day he completed his doctoral thesis at Harvard, pulsars—the dense, cinereous star remnants left after a supernova explosion, which emit constant radio signals—were discovered. Taylor decided to make them his specialty. Since that day nearly 330 pulsars have been identified, and about two-thirds of them were found by Taylor.

Early on in our conversation this tall, straightforward, and unpretentious scholar expressed some doubt that the MacArthur grant really suited his style of work. "What Rod MacArthur had in mind is less well designed for a scientist like me than for a writer or a musician," Taylor said.

"Constant contact with students is my source of ideas, my life's blood. To withdraw to write by a tree somewhere or simply to do research wouldn't help me at all. There could be some small benefit in reducing a few faculty responsibilities, meetings and the like, but since I'm relatively new at Princeton, I'm enjoying that, too. Perhaps in another two years there might be a small change. I might go on half-time for a year. The MacArthur grant means for me a slight midcourse maneuver."

These words were not said in an ungrateful tone, for Taylor is greatly pleased by the honor of the MacArthur award, without knowing exactly what the honor is for. (No citation giving the foundation's reason for conferring a fellowship is ever conveyed to the recipient—a fact that increases the mystification of the younger, more competitive prize fellows.) Taylor sees the MacArthur vision as the American equivalent of the Nobel Prize, with the additional benefit of not just honoring the scientist but facilitating his or her creativity.

Taylor's own work, however, depends upon the kind of immensely expensive computer equipment and radio telescopes that only a large institution or a consortium of institutions can provide. The highly sensitive tests in the atmosphere that he carries out require the use of such giant facilities as the National Astronomy and Ionosphere Center at Arecibo, Puerto Rico, and the National Radio Astronomy Observatory, in Green Bank, West Virginia. Using this equipment, Taylor believes a significant breakthrough for him would be either to discover the dynamics of a neutron star, which is a complicated problem in mathematical physics, or to uncover, as an extension of Einstein's relativity theory, the unifying principle that links gravitation with the three other basic forces of nature (electromagnetism and the two nuclear forces). And, although he believes that trying to discover extraterrestrial life is a waste of time, given the infinite directions from which a radio signal might come, the techniques used in pulsar research, he said, could even accidentally detect radio signals sent by other beings.

Over the years Taylor has had adequate funding from the NSF for virtually any research he wished to conduct. Far from inhibiting him, his institutional base has helped him progress. The fact is that, by being at Princeton, he was already well situated to fulfill his potential before the MacArthur Foundation entered his life.

David Pingree's circumstances at Brown University in Rhode Island are in marked contrast to Joseph Taylor's. I found Dr. Pingree in an ornate but compact, two-story house on the edge of the Brown campus.

designated, the handpainted sign outside informed me, for the History of Mathematics and Egyptology. A sunny Yankee of forty-nine greeted me, his hair short, gray and unkempt, appraising me owlishly through small, round, wire-rimmed glasses. His office is one that might have belonged to Copernicus: a blackboard, bookshelves piled to the high ceilings with dusty manuscripts, a round oak table washed with the northern light from a high window and strewn with Sanskrit documents.

I realized instantly my preconception of Dr. Pingree was incorrect. His biography noted he is a professor of the history of mathematics and a member of the Medieval Academy of America, the Renaissance Society of America, the American Philosophical Society, the History of Science Society, and, of all things, the Visvesvaranda Vedic Research Institute. His major work (three volumes) is *Census of the Exact Sciences in Sanskrit*. He is proficient in Sanskrit, Assyrian, Arabic, Greek and Latin and has studied Latin paleography at the Vatican as well as Byzantine astrology. I expected a brilliant generalist and, perhaps, a bit of a genuine Mac-Arthur oddball whose interests span many disciplines. Instead I found a brilliant particularist—a scholarly philologist fascinated by the transmission of scientific knowledge from India to Europe and China. His familiarity with mathematics, philosophy, and astronomy, as well as ancient-medieval and Renaissance history and all those esoteric languages, is not the product of a flickering mind, but a necessary adjunct of his specialty.

"The texts are what interest me," he explained, "but I also have to understand the science they are talking about."

As Pingree sees it, modern science is completely dominated by the West and Western values, but it has not always been this way. The special contributions of India and the Middle East to mathematical and scientific knowledge excite him very much. Babylonian arithmetic, for instance, influenced the astronomy of the ancient Greeks, and in modern times the Indian discovery of the power series in trigonometry has had an immense influence on present-day mathematics. Pingree's mission is to analyze in detail how the Indian civilization dealt with the world around it.

But therein lay problems. The Sanskrit manuscripts that treat astronomy and astrology were written on paper that has begun to disintegrate. As a further complication, many of the manuscripts are kept in small family libraries scattered throughout India, usually in the homes of teachers. In addition to these problems, the Indian government has no interest in saving such rare manuscripts.

Like other prize fellows, Pingree has had little trouble in getting money for his work. The NSF, the American Philosophical Society, and the Rockefeller Foundation have all been his benefactors. So I posed what would become a standard question: "Didn't

you ask yourself at the outset 'How can I justify this enormous investment [$236,000] in me?'

'That was my initial reaction,' he said pertly, 'but it didn't last long. I quickly found there was a good way to use the money.' He smiled almost impishly.

Pingree plans a huge rescue operation of scientific Sanskrit manuscripts. In India, where photocopying services are scarce, his grant money will hire an army of scribes to go throughout the country and copy the decomposing manuscripts. So the prize fellow will have his own fellows, scores of them. ('Pingree's chaps' we started calling them.) Hiring a professional scribe in India costs about as much as getting a document photocopied, he remarked, and is considerably more humane. Before the award he could afford to transcribe only 50 manuscripts. Now he can save thousands. The MacArthur grant has brought if not a shift, at least a considerable acceleration in his work. It has meant to Pingree something more than a slight midcourse maneuver.

'Will there be any breakthroughs from this effort?' I asked.

'Not a great intellectual breakthrough, no,' he replied. 'But it will lead to a greater understanding of Indian astronomy. There will be a number of little breakthroughs. There will be a record of how a whole civilization dealt with the world around it.'

Has he discussed his plans with the MacArthur Foundation?

'No. They have not asked, and I have not volunteered,' he answered. 'Their questions are very practical,' he added, like where they should send the check every month.

I saw Pingree on a frigid afternoon with subzero winds coursing through Providence at 40 miles an hour. When we had finished our talk, I inquired hopefully whether, if he were driving someplace, would he give me a ride to the train station. He seemed inordinately pleased by the question, in light of all the newspaper publicity about all the new cars and exotic vacations the MacArthur fellows supposedly were enjoying on foundation money. Again a smile transformed his face.

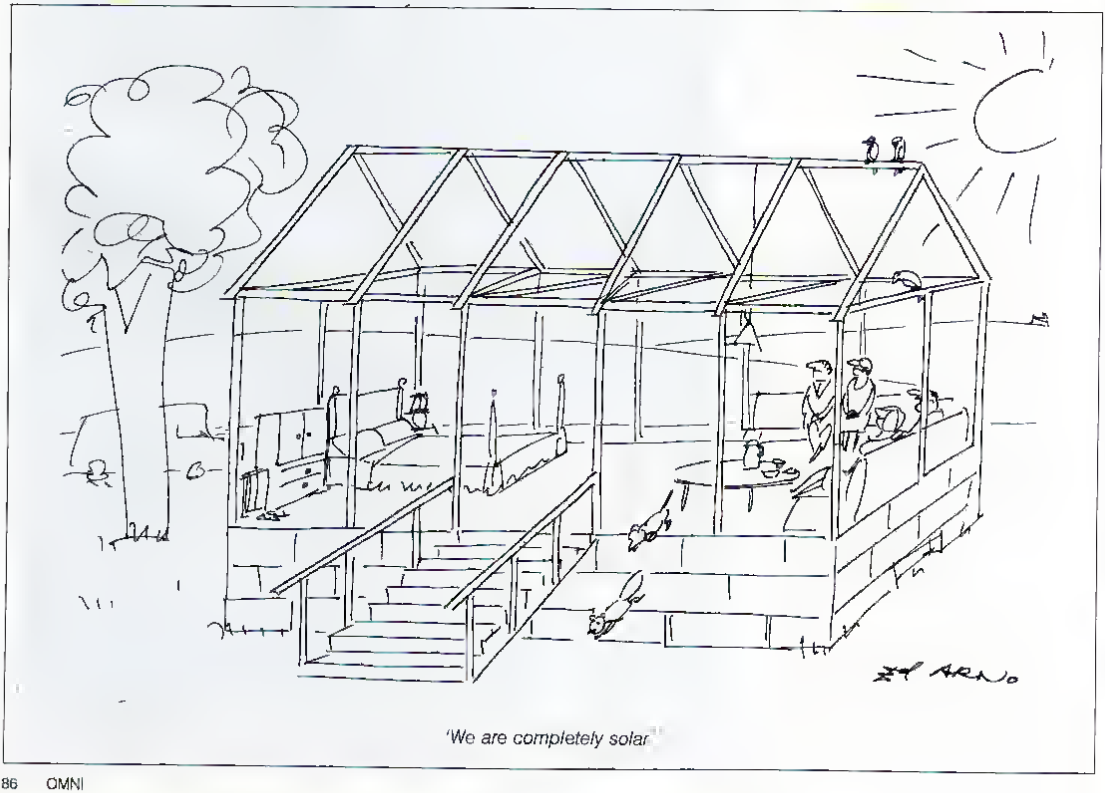
'But I don't have a car,' he said.

Still not completely satisfied, I continued to stalk the perfect embodiment of the MacArthur vision. Traveling north of New York City to the Lamont-Doherty Geological Observatory, in Palisades, New York, I sought out Paul G. Richards, a British-born American-naturalized theoretical seismologist who, like Taylor and Pingree, had received the blessing of the MacArthur Foundation in November 1981. Perched upon the Palisades, overlooking the Hudson River, the Lamont-Doherty Observatory is owned by Columbia University and is one of the leading institutions in the world for the study of earth sciences. The observatory has in residence more than 100 Ph.D.'s who might be concentrating, as Dr. Richards would soon assert, on anything from pollution in the Hudson River to rice culture in Indonesia.

Tall, thin, with a copious beard and less copious hair, Richards cut a figure somewhere between young Abe Lincoln and a Russian novelist of czarist days. He was quite nervous about the limelight into which his uncertain distinction had thrust him. His own concerns and fortunes have been very much bound up with the development of his observatory during the last ten years. His pride in its accomplishments was more on his mind than his own were. At thirty-eight, he had already been chairman of the considerable faculty at Lamont-Doherty and chairman of Columbia's department of geological sciences. Indeed, as the associate director of Lamont-Doherty he had been consumed by administrative tasks for a year and a half and had not been practicing science at all. Like the other recipients, he did not know why he had been certified by the MacArthur Foundation.

This mystification was by now becoming familiar to me, but I thought Richards's uneasiness over his prize fellowship was uncommonly acute.

'There are many distinguished scientists in my field who have far greater sci-




*'We are completely solar.'*

entific accomplishments than I and whose work is referenced extensively," he said. "I have never really had a sense of having had any huge scientific accomplishment."

But his work has been honored by the American Geophysical Union. It has taken two directions: predicting earthquakes and distinguishing between natural earth tremors and clandestine underground nuclear tests. It is this second area where the MacArthur fellowship has begun to work as a psychological prod, a "kick in the pants," Richards called it.

The contribution that he might make, the breakthrough in MacArthur parlance, is being able to pinpoint exactly the kilotonnage of an underground nuclear explosion. In the 1950s and 1960s considerable funds were poured into seismology for research into detecting weapons tests—so much money in fact that the entire field of seismology was transformed. The Test Ban Treaty of 1972, which has never been ratified by the Senate, states that the threshold for the safe policing of underground explosions is 150 kilotons, 11 times the size of the Hiroshima bomb. Richards thinks he can do better.

"The science of discriminating [between natural tremors and underground nuclear explosions] is behind us," he said. "Now the question is how to determine the yield of an underground explosion. What is the threshold at which the kilotonnage of an explosion can be established? I believe it is considerably lower than one hundred fifty kilotons, and I believe I could establish the precise threshold. If that can be defined scientifically, then it follows that there is no reason not to sign a test-ban treaty."

Aware that the MacArthur grant has given him a license to gamble ("I no longer have the traditional reason to come to the office in the morning," he observed), he is holding back from pursuing this scientific goal, at least for now. His loyalties to the Lamont-Doherty Observatory are strong, and he has doubts about what would be his most effective course.

"Is it foolish for me to walk away from an institution that is making these very considerable discoveries?" he wondered. "Would I be effective in taking my one small voice into such a large area as the arms race? But if I could establish the threshold, there would be no reason to stop there. As a technical expert in identifying nuclear explosions, should I move on to become an advocate?"

"Something like Bertrand Russell?" I asked.

He nodded in assent. "But if I should launch out on my own, break connections, become a talking head, I don't have any guarantee that I will be effective."

This is an old dilemma, but it is one that sudden independence has drawn very sharply for him. Perhaps he would have faced his dilemma sooner or later anyway. He hastened to add that there are government agencies that would be quite ready to fund his research into threshold questions, but he might be directed a bit more strictly than he would like. Now the MacArthur grant has brought a certain urgency to his thinking, and while the foundation would never say so, one suspects the board would be pleased.

Finally there was Gregory Chudnovsky. He fitted the American image of genius with the greatest precision. A Russian Jewish émigré, he is already a prolific mathematician at twenty-nine. Along with his family, he had requested repatriation to Israel but had been branded a *refusnik* by the Soviet authorities, and his parents were beaten—something he shudders to recall. Eventually the Soviet government allowed the family to leave the USSR, and the Chudnovskys came to the United States, but only after the intervention of Andrei Sakharov.

A native of Kiev, Chudnovsky published his first scholarly paper for the Soviet Academy of Sciences at the age of sixteen, and two years later he became the youngest recipient of the prize of the Moscow Mathematical Society. A year after he arrived in New York City, he became a research associate, along with his brother David, at Columbia University's mathematics department. All this he had accom-

CONTINUED ON PAGE 104

*"I'm afraid I'll have to let some of you go. The people are complaining about excess prophets."*

# VISIONS OF MAN EVOLVED

BY PAMELA WEINTRAUB

A bulbous, red-veined creature with thick webbed claws clings to a 100-foot-tall tree and waits for dawn. When the first rays of sun creep across the flat, deadened plain, the animal sprouts fanlike blossoms that soak up the heat. Thus energized, it floats down to a pulsating lake and drinks through a trunk suspended from its midriff. A face is now visible amid folds of skin and veins. A human face.

The time is 50 million years in the future, on the planet Earth. And the hard-shelled, dark-skinned creature swooping from the mossy branch is our own descendant.

This future man (opposite) and the animals on the pages that follow were designed by Scottish paleontologist and model maker Dougal Dixon, author of the critically acclaimed book *After Man*. In *After Man* Dixon portrays the animals and plants of a future world in which man had become extinct. Now responding to a suggestion by *Omni*, he has come up with an alternate scenario in which man survives. (Dixon produced rough drawings of this futuristic world, which were turned over to artist Diz Wallis, who did the final renderings shown on these pages.)

The higher up the evolutionary ladder organisms climb, Dixon explains, "the faster they're likely to become extinct. A group of shellfish, for example, might last sixty million years, while carnivorous mammals would last six million. Man, who's been on Earth half a million years, has already begun to decline."

The cause of our deterioration, Dixon says, is medical science, which each day spares thousands of people suffering from disease. In centuries past, he contends, individuals with maladies ranging from asthma to diabetes would have died before adulthood. But today they live on, and,

ILLUSTRATIONS BY DIZ WALLIS

*"Birds inhabiting the forest floor will develop muscular necks to help them snake through the brambles."*

as they reproduce, they transmit their genes from one generation to the next.

As the millennia pass, Dixon believes, our genetic "load" will grow heavier and heavier, burdening almost everyone with debilitating disease. Eventually our hearts and lungs will collapse, our muscles will atrophy, and we'll rely on technology for survival.

Man millions of years hence will be a pathetic bundle of withered organs and limbs, Dixon predicts. "He'll have a shriveled, useless body and paralyzed legs, with only the sex and sense organs intact." Yet his brain will have flourished and grown. Ten times heavier than the rest of the body, it will provide him with psychic powers and enough intelligence to persist.

In fact, 50 million years from now man will be smart enough to genetically engineer a whole synthetic body, one that will surround and sustain the *real* body from the moment of birth. Dixon portrays that far-distant descendant in various configurations on page 94. At the bottom of the page, tomorrow's man dangles nude, his meager physique far too frail to sustain his bulging, prodigious brain. In the picture at the top right, though, he has entered his crucial life-support system—a nutlike shell strung with an array of healthy body organs cloned from ancient genetic stock. Built to supply man's every need, it will come complete with a trunk for feeding, uplifted leaves to gather sunlight, and claws for roosting in trees.

For by then the trees will have become man's home. During the first 5 million years of human life on Earth, Dixon explains, man will have depleted forests and fields, obliterated mountains in his search for minerals, and colonized every square inch of the land and the sea. The planet will become a crumbling wasteland, its valleys turned to desert and its oceans crammed with garbage from generations past. So in 50 million years, with few resources left, man will live out his life atop looming hardwood trees. He'll grow his edibles in lakes of blue-green algae that have been genetically engineered to convert sunlight into human food. And to eat, he'll employ his expanded mental powers, "willing" nourishment up from the lake or teleporting himself down for a meal on the shore.

Floating over his arboreal society, man will see a landscape far different from anything his ancestors knew. A heavy mist will blur the plains, now dense with wild grass and trees. The emerald glow of algae lakes will pierce the fog. Here and there will be a glass dome, inhabited by visiting "outlanders"—the offspring of humans who left Earth for distant planets millennia before.

Stretching out from the domes in every direction, the underbrush will swarm with life. Though mammals will have perished during the centuries of human destruction, birds will make their homes in burrows and caves. Having survived

*"Body organs made by inept scientists will attach to scavenging animals, forming semihuman hybrids."*

by soaring high above the carnage, they will virtually dominate the planet. Hoofed species traversing the grasslands (depicted on page 92, at left) will sprout long, nimble legs to escape their powerful predators (page 91, right and left). Birds at the edge of man's protein-rich algae lakes (page 92, right) will nestle deep in the ground, while those inhabiting the forest floor (page 93) will develop muscular necks to help them push through the brambles and vines.

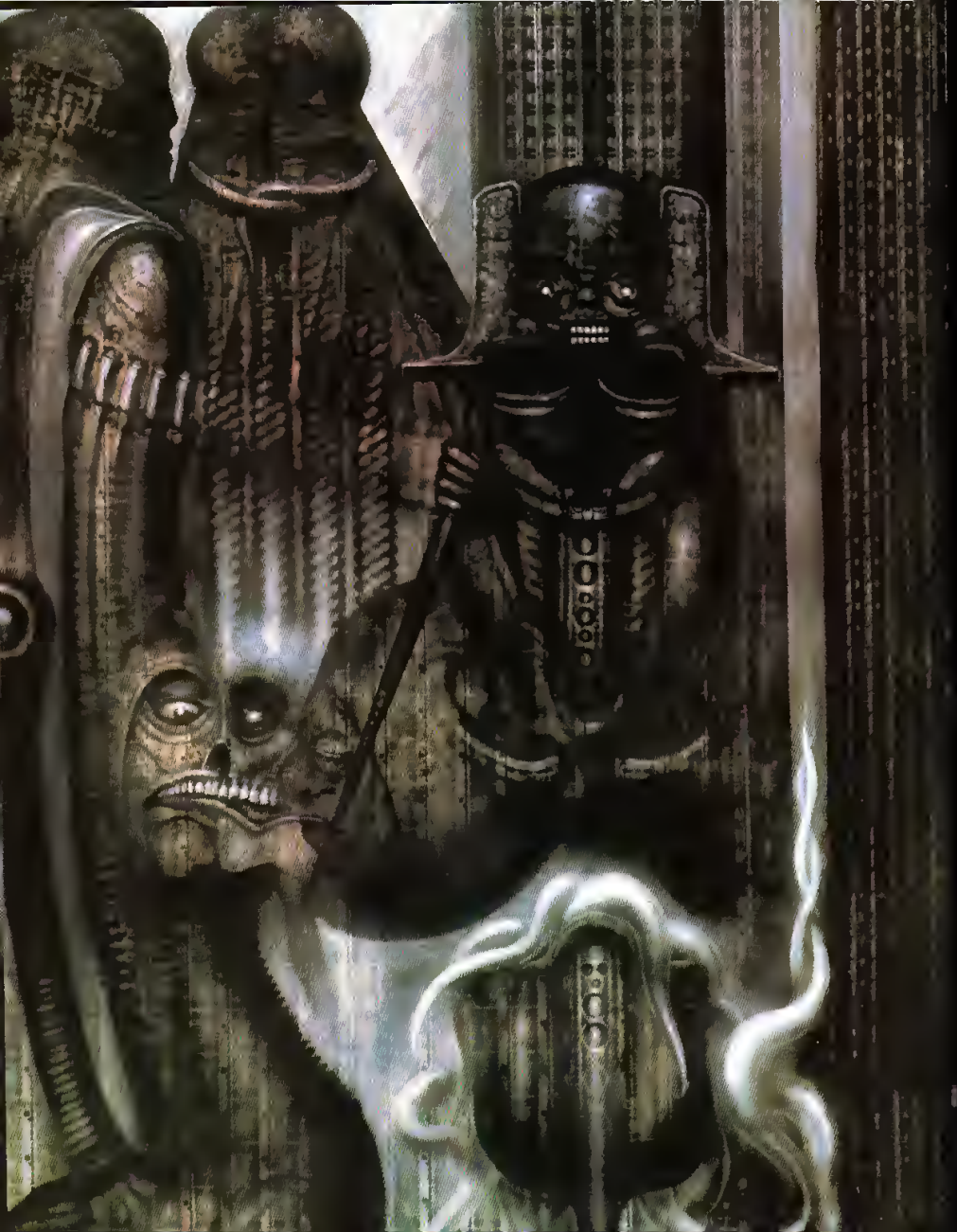
Another sort of creature, says Dixon, will also stalk the wilderness: "monsters" created by careless genetic engineers. Discarded human body organs made by inept scientists will inevitably have attached to inquisitive scavenging animals, forming bizarre hybrid creatures like those on this page. Then, every so often, a few cells from the human organ will fly off from these animals and attach to a nearby mate or offspring. The cells will eventually mature into another identical human organ, and in this way one hybrid creature after another will be formed.

Usually, Dixon says, the extra organ will sap these creatures of energy, and their particular strain will last only a generation or two. But occasionally the extra lung or heart will confer some advantage to an animal, enabling it to run or breathe more efficiently than its brethren. "That creature would then flourish, and if it were particularly successful, it might provide seed for the next phase of life."

Dixon's picture of our future world may be appalling, but, fortunately, few scientists share his view. "I don't see how the individuals Dixon postulates could persist," says physical anthropologist Noel Boaz, of New York University. "Evolution proceeds through the law of natural selection, which states that the fittest survive." So if there were just a few able-bodied individuals, they'd probably continue to reproduce, while their competitors—Dixon's puny humans—met a swift but timely end.

Anthropologist C. Owen Lovejoy of Kent State University in Ohio adds, "If we have the ability to genetically engineer bodies, then we could improve human anatomy, not reduce its effectiveness. We could make individuals live longer, suffer less disease, run more efficiently, and so on. They'd be much better adapted to the earth than any of us are now."

Most other researchers agree. Molded by natural selection and gene technology, they say, future man will *strengthen* his body and mind. According to Baltimore gerontologist Richard Cutler, the resulting superhumans would reach sexual maturity at twenty-six, middle age at eighty, then live until two hundred or more. Their brains would be twice as large and powerful as ours. "A bigger brain requires more energy," Cutler adds, "and so the future human would need a larger body—not a smaller one—to provide it." ∞



PAINTING BY H. R. GIGER

FICTION

*A spaceship's first officer must uncover the secrets of his past in order to survive the present*

# NUMBER 13

BY STEPHEN ROBINETT

I found their skeletons later. At first I was too busy with mission decisions to think about much else, too struck by the silence to anticipate anything but an empty ship.

Silence. After a millennium I expected noise. Things wear out. A bearing squeals a pained wail through the empty corridors, a malfunctioning air duct vents a slow hiss, an emergency Klaxon bleats. But when I pushed up the translucent blister covering the flotation tank and listened, I heard only silence, the ship as perfect as the day it left Earth orbit, a watch that's been ticking on time for a thousand years.

I stood up and wiped anabiotic slime off my body with both hands. When I stepped out of the tank, the static-charge shower activated itself. Even the shower functioned in silence. Abruptly I was clean, the nurturing soup of a five-year gestation vanishing completely from my skin in an instant.

I put on fresh coveralls and started for the bridge, padding barefoot over the cold metal floor plates, the whisper of my feet audible around me. On the bridge, I stood in front of the main console, surrounded by a panorama of blank and lifeless computer screens.

"Mission status. Visual information display."

Screens lit. Half displayed data on ship's systems and planetary approach. Half relayed the view outside. Ahead of me lay a world green and blue and swirled with white. almost Earth. Almost.

"Star system and planetary analysis."

Data overlaid the planet's image. I searched it for problems. Fifth planet of a G spectrum star . . . fourteen-hour rotation period . . . relatively uniform temperature gradient . . . oceans dense with local equivalents of algae and plankton . . . probably a breathable atmosphere . . . equatorial and polar landmasses . . . anomalous radiation emissions . . . recent and extensive outflowings of magma over both landmasses. (*Magma?*)

"Surface volcanic activity." Negative.

"Magnetic field data." I whistled in surprise at the number on the screen—two hundred gauss—as I said, "Only almost Earth." *Why so strong a magnetic field?*

"Planetary core data." *Bingo.* The planet's core, an outsized ball of molten iron, created a magnetic field two hundred times the strength of Earth's. Combined with the planet's fast spin,

the strong magnetic field produced the anomalous radiation effects picked up by the ship's detectors None of this necessarily made the planet uninhabitable It did raise a caution flag

I stared at the screen and thought about magma trying to turn up some connection that the ship's planet-selection program might have missed 'Correlate ten-year weather data with magnetosphere data'

Bingo, again but bingo you lose

The large core and fast spin gave the planet an unstable magnetic field Every few years the field collapsed, transferring energy to the molten core and cracking the planet's crust The landmasses ran red with the glowing blood of the planet In short the bottom had just dropped out of the local real estate market

A feeling of sick disappointment swept over me The situation left me no options

'Abort approach Reset long-range scans Prime re-creation tanks for next cycle And get that damned hunk of treacherous rock off the screens'

The ship queried my last instruction

"Clear outside visual display."

Screens blanked out a window closing sealing me in

'What now, guys?"

Silence answered from the screens answer enough and an answer I already knew A decision aborting a planetary approach amounted to a death sentence The ship bypassed the planet and continued its slow search for a suitable colony world The deciding officer lived out his life in the perfect and unchanging environment of the ship his key mission decision behind him a dribble of useless days ahead of him As a re-creation of the original crew's First Officer I knew the consequences of my decision as clearly as did my prototype a millennium ago on Earth though he never considered the matter of much importance Why should he? Aboard the ship only to train he would never have to live out the consequences of an abort decision

I did have one item to take care of Claire I was about to initiate her re-creation cycle when a noise interrupted me a rumbling sound I listened almost hoping for a malfunction in some ship's system Again it rumbled, Finally I identified it A million million kilometers and a thousand years from anywhere a man's stomach growled I decided Claire could wait The condemned man deserved a good meal

I left the bridge and walked quickly toward the ship's galley Only the occasional whisper of my footsteps on the floor plates broke the oppressive silence Impulsively I felt tempted to order up a brass band from the ship's library I liked the idea of the empty and receding corridors filled with the reverberations of trombones drums and marching feet The impulse passed More than a brass band, I wanted Claire

I turned in at the galley, already anticipating my first meal I stopped short in the galley doorway my appetite fading On the floor in front of me lay two skeletons gray bones picked clean by bacteria

I knelt and examined them, one skeleton male one female A thin blade of carbon steel discolored the rusty brown of dried blood protruded from the male's ribs The female's neck was broken One blow from the dying man?

What happened? A domestic quarrel producing domestic tragedy a sudden explosion of long-repressed rage perhaps triggered by a dispute over who would dice onions who chop celery?

Though I stared impersonally at the bones on the galley floor I knew they were identical to my own genetic duplicates as had been the man himself the man who aborted the approach to some other world the man who died with a knife in his heart

And the woman? Undoubtedly Claire in that he had no choice As landlords the mission planners left something to be desired They allowed us long-term tenants only one pet sterile but according to thousand-year-old psychological profiles theoretically compatible

I looked at the knife in the skeleton's ribs arguably a lapse in our confidently predicted compatibility

Still the psychologists' decision bound him Once he aborted the planetary approach the ship allowed him only Claire Everyone else dead a thousand years on Earth waited patiently to be born piles of genes and engrams under the watchful care of the ship's double redundant systems Why clutter their perfect ship with more useless lives than necessary? Give the old castaway Claire and forget about him

I touched Claire's skeleton nudging it The rib cage rocked gently on the floor I remembered long afternoon walks holding hands long evenings talking long nights making love I remembered feelings not love but a possibility of love I remembered a complicated woman and quarrels

I stood up and looked at the bones The two skeletons faced each other as though the moment of their violence passed they lay down to die together

I left the galley and walked the ship brooding on these skeletons in my closet Later only half-aware of where I was I looked up to find myself in the re-creation vault I walked past the rows of tanks to Claire's and stood looking down at it like a man visiting a grave I imagined a shape growing beneath the translucent blister, the shape of my companion my friend, perhaps my murderer

Did it always end the same? Did we always live out some sort of perfectly controlled experiment in human psychology nature nurture and environment identical everything identical even the ending?

I left the re-creation vault and walked slowly through the empty corridors to my quarters I lay down across my bunk my head propped up with my hands staring between my elbows at the small ship's console beside me its blank screens echoing the larger console on the bridge

'Ship's log How many planetary approaches to date?

A screen lit briefly answering Including my own thirteen Twelve other approaches twelve other re-creations, twelve other decisions to abort more important twelve opportunities to watch identical rats run through an identical maze to collect data and form conclusions before I made any final decision about Claire

'Ship's log Replay planetary approach number one from the point of First Officer Colwin's tank exit

Days passed How many I have no idea Once I began searching the log excavating the bones of the past my life fell into a monotonous pattern of indistinguishable days and identical routine I woke ate exercised and slept I searched the log staring long hours at a soap opera starring me I seldom went to the bridge and never looked at the stars outside more interested in echoes from the past than in the silent future

I left the skeletons on the galley floor as a reminder a question partially answered At meals I talked to them—Mr and Mrs

Number Twelve—already dotty in my youth talking to skeletons. I told them about the results of each day's excavation. They seemed less than interested, silent their rib cages casting rib cage shadows on the galley floor, a knife-blade shadow.

Gradually data emerged.

Once Claire outlived me; once I outlived her; once we died together in each other's arms after a long and happy life; the only violence between us an occasional cross word. Twice it ended with murder, but murder for different reasons and, to my surprise, with different murderers. In that we took turns.

The longer I watched, the more despondent I became. I learned one thing quickly. It never ended the same. Twelve times the environment of the maze stayed the same. Twelve times the rats stayed the same. Yet twelve times it ended differently, with no ending any more predictable than any other. Even in later cycles, when I watched myself turn to the log for guidance—at times watching myself watch myself watching, a bleak and depressing hall of mirrors stretching back centuries—no pattern of improvement appeared. What had Number Twelve learned about how to avoid a knife in his heart? No wonder I talked to skeletons.

I hit bottom on the eleventh cycle. I watched Number Eleven leave the re-creation tank, discard a world of flesh-corroding rains, discover the previous log entries, and begin his search. I watched his growing frustration and confusion. I sympathized. I watched him complete his search and lean back across the bunk, a look of acute pain suffusing his face, like a mourner at the funeral of a lifelong friend.

What went through his mind? That he knew everything he would ever know about the consequences of a decision to re-create Claire and still knew nothing but uncertainty? Perhaps. For men trained to evaluate data and decide, uncertainty brought pain.

I watched him get up, leave his quarters, and walk slowly to the bridge, the unvarying illumination of the corridors around him a reminder of the bland eternity before him. He reached the bridge and stood surrounded by the screens. Unexpectedly he ordered up a full outside view, something no one had done before him.

He ordered the bridge lights dimmed until he stood visible only by the light from the screens. Around him, unwavering, stars shone brilliant pinpoint specks against the blackness. I looked at his face. Tears glistening in the starlight ran down his cheeks. A heart-rending wail escaped his lips, pitiful and despairing, filling the empty ship. Later he chose a life alone and miserable, old man, died alone on the bunk where I lay watching him die.

When the screen finally blanked out, I sat a long time on the edge of the bunk. Number Eleven's despairing wail in my ears. I understood why he dimmed the bridge lights and ordered the outside view, opening the window to an infinity of stars, an infinity of possibilities. I understood his forlorn cry of utter desperation in the face of utter uncertainty. One thought kept me from joining that despair: the bones on the galley floor.

Why, knowing what we both knew, did Number Twelve choose to re-create Claire?

Ship's log. Replay planetary approach, number twelve from the point of First Officer Colwin's tank exit.

A twelfth time I watched myself emerge from the tank, trot to the bridge, and reject an almost-Earth. I watched myself order up a meal in the galley, eat, and go to my quarters. I watched myself find a skeleton in the doorway, the bones of Number Eleven.

My sense of futility deepened. Number Twelve was following the same well-worn path we all followed. He even left the bones in his quarters, propping them up as best he could in one corner and talking to them from time to time.

I indexed the log forward through Number Twelve's long days excavating the bones of our common past. Finally he arrived at Number Eleven's decision to live and die alone. Even secondhand, Number Eleven's sorrowful cry touched me, as though it were the uncomprehending moan of a child in pain.

Number Twelve watched it twice, sat back across the bunk, and looked at the skeleton in the corner, his expression more thoughtful than moved.

He shook his head slowly. "You were wrong, you old fool."

He pushed himself up from the bunk and left his quarters, retracing Number Eleven's path to the bridge. He stood on the bridge, surrounded by the screens, and ordered a full outside view. The infinity of stars and their infinite possibilities filled the screens. He ordered the bridge lights dimmed, then extinguished. He stood a long time staring at the stars. Finally a sound came from him, inaudible at first, then louder, laughter.

He looked from screen to screen around the panorama of screens and laughed, his laughter as moving as Number Eleven's wail. Tears of laughter, glistening in the starlight, ran down his cheeks. He ordered the ship to initiate Claire's re-creation cycle.

I froze the image on the screen and lay back across the bunk, studying it. Frozen out of context, it was impossible to tell whether the starlit tears came from laughter or despair, whether the face belonged to Number Eleven, Number Twelve, or even me. Nor did it matter.

I stood up, stretched, and yawned, at ease with myself for the first time in days, welcoming the uncertainty ahead of me. It never ended the same. I ordered the ship to leave the image permanently on the screen, then told it to initiate Claire's re-creation cycle. I left my quarters and started for the galley. I still had a few other bones to get out of the way. ∞


"Ask me about our fuel bill."

# GENIUS HUNTING

CONTINUED FROM PAGE 88

plished essentially from a prone position. Since the age of eleven, when he contracted muscular dystrophy, Chudnovsky has been confined to a bed most of the time. If living with adversity deserves special reward, the MacArthur fellowship for Chudnovsky was especially just.

Although he had been feeling particularly ill for some weeks, he agreed to see me when I expressed interest in his work on Sakharov. His mother greeted me at the door of the family apartment near Columbia with a kiss on the cheek and ushered me down the long, narrow hallway of their railroad flat to Gregory's bedroom. At the doorway, his brother David introduced himself and launched immediately into the subject of Sakharov, handing me a poster for a conference honoring Sakharov on his sixtieth birthday—a conference the Chudnovsky brothers had helped to organize.

Propped up in his bed, Gregory cut a painterly figure. A dramatic shock of hair spread across the headboard, and his thin, triangular face was pale from fever. His large, luminous eyes danced with joy at an opportunity to talk about his mentor, Sakharov. The name was spoken so often, and with such reverence, that the moral obligation the Chudnovskys feel for the defamed scientist is inspiring.

"We are just scientists," Gregory said, gesturing toward his brother. "Sakharov is a great scientist, a Russian saint, representing what is best about Russia. A scientific and moral genius, who speaks with complete moral and scientific authority."

Their MacArthur fellowship (it was clear that the brothers were the closest of colleagues) has led them to begin a remarkable project: publishing the collected scientific works of Sakharov. They spoke about this task with great animation, as their mother alternately served tea and orange slices and patted her son's fevered brow. Sakharov's defense of the Chudnovsky family evolved into a professional relationship, and in 1977 the brothers spoke with the physicist about preparing a collection of his writings. But once the Chudnovskys arrived in this country, contact was difficult. The original idea, that Sakharov contribute commentaries for his scientific papers, became nearly impossible to achieve. In 1980, when he was exiled to Gorky and stripped of all his Soviet awards, he was also denied access to his papers and his scientific colleagues, too. In March 1981 his Moscow apartment was ransacked and his scientific notebooks were stolen. Working completely from memory, Sakharov still managed to send his comments about his papers, as best he could remember them, to the Chudnovskys in New York. Relayed through intermediaries unknown to the Chudnovskys, letters would reach them as much as a year after they had been dispatched. The result was the collection that lay in galley proofs next to Gregory's bed—a collection that the Chudnovskys hope will take the reader into the "kitchen" of Sakharov's mind. Nobel laureate Dr. Arno Penzias, of Bell Laboratories, remarked that Sakharov's insights "into the still-vexing problems of inhomogeneity in an evolving universe" were of great value, and Dr. Val Fitch, of Princeton, wrote, "Looking back fifteen years at the physics papers of Andrei Sakharov, one has to be tremendously impressed by the prescience of the man—lepton nonconservation, baryon nonconservation. Before the grand unified series, these were unthinkables, and he dared otherwise."

Here at last was a project that seemed to fit the MacArthur vision to the letter. It was a celebration of creativity twice over. It gave young, brilliant mathematical physicists the support to pursue a project for which no traditional grant existed, and it was itself an acknowledgment of both scientific and moral genius.

It was not easy to imagine what it must mean emotionally to these mathematicians to have moved in the span of five years from being the persecuted victims of a totalitarian state to becoming the happy beneficiaries of a capitalist society, nor were they especially interested in commenting on those topics. They chose to view the MacArthur fellowship as simply the romantic product of the democratic society, a phenomenon uniquely American.

"But that," Gregory said, "is outside the scope of science. Let's stick to something that is more precise."

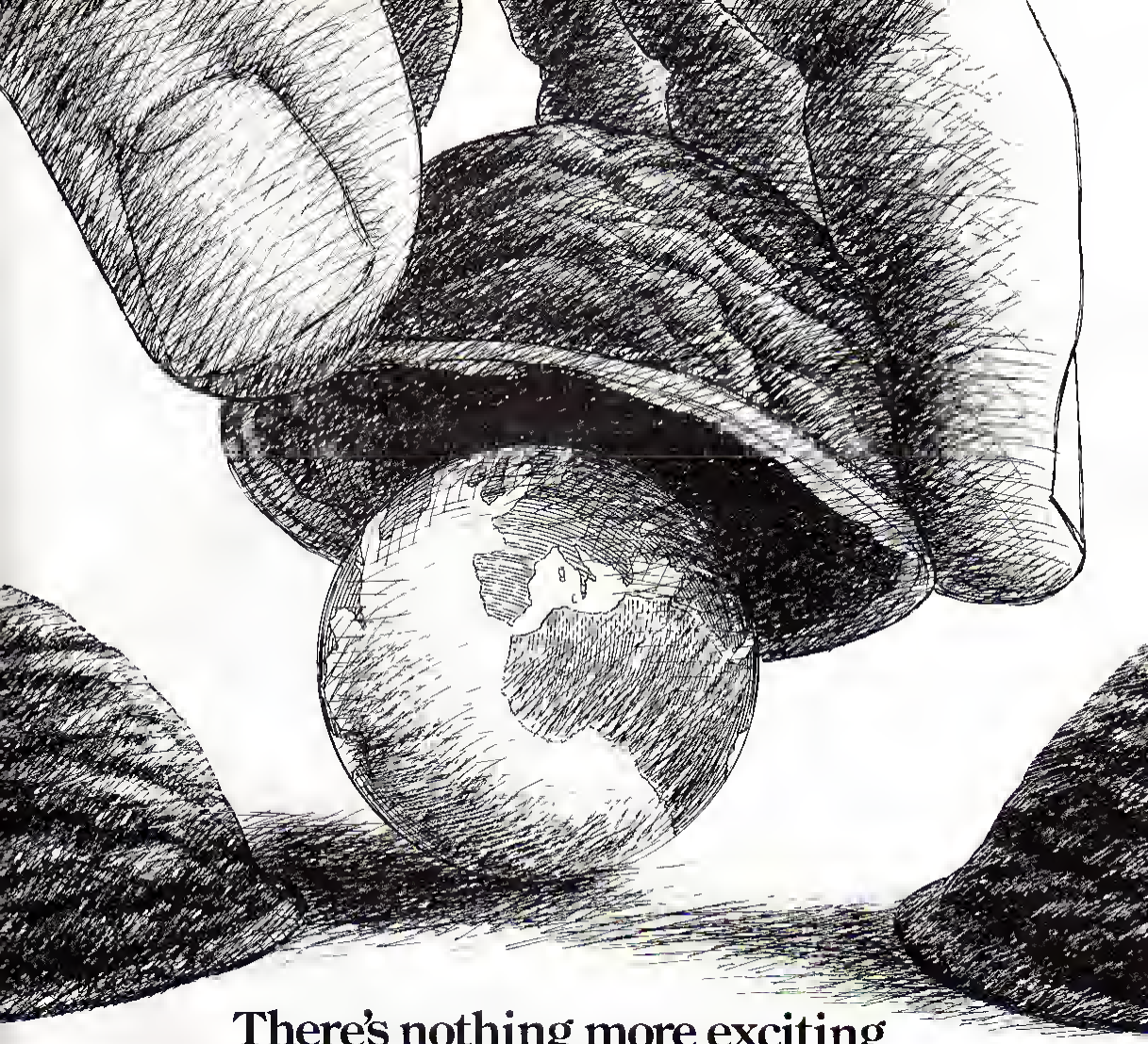
*"Wait. Here's one. 'Wanted: Dynamic young man, must be bilingual.'"*

From Joseph Taylor's slight midcourse maneuver and David Pingree's "chaps" and Paul Richards's creative tension and Gregory Chudnovsky's poignant tribute to Andrei Sakharov, a few conclusions emerge.

The MacArthur vision could move certain gifted individuals to greater heights and broader contributions, but the selection process needs to be honed more finely if it is to discover individuals for whom a lot of money really will make an essential difference in their professional lives.

The foundation is miles away from having a system that identifies the genuine maverick truly inhibited by institutional life. Further, it seems to have no notion of how to recognize a prodigy in the making, say a young Robert Penn Warren before he writes an *All the King's Men*.

Finally, its insistence on secrecy in the selection process and the fact that the first recipients were so heavily concentrated in the Ivy League can only sow doubts about the foundation's objectivity and seriousness. So long as the selectors and the values they employ in their choices remain a mystery, what the MacArthur fellowship conjures up is not the Nobel Prize but the Irish Sweepstakes. And it will remain a curiosity, amusing the public and baffling its beneficiaries. ∞



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*The Making of the President, the Year 2000— America's foremost political pundit casts a cold eye on the future of the Republic*

# INTERVIEW

# THEODORE H. WHITE

Probably no one has seen more of, written more on, or written with more precision about, the events that have shaped the last 40 years of world history than Theodore H White A scholar and historian White calls himself a reporter On more pretentious occasions he calls himself a journalist Being all of these things, Teddy White has chronicled the making of American presidents in such rich detail that he has changed the way Americans choose their top executive officer

During World War II White served as a correspondent, covering China for *Time* magazine He saw the end of the war on the deck of the battleship *Missouri* when the Japanese surrendered to General Douglas MacArthur White was witness to the start of the Cold War and the North Atlantic Treaty Organization before putting postwar Europe behind him and returning to the United States to take up political reporting In 29 remarkable years White covered seven presidential elections and wrote five books about what he saw and heard throughout those campaigns

PHOTOGRAPHS BY JOHN MUTH

*"In twenty years the United States will be far more nationalistic, self-centered, and protective of its own interests than it is today."*

His first campaign book is still his most memorable. *The Making of the President—1960*, revolutionized the reporting of politics. For the first time an American political writer took his readers behind the scenes of politics in an election year and explained to them in detail how and why John F. Kennedy defeated Richard M. Nixon.

In 1956 White was one of five reporters who turned up to cover the New Hampshire primary. In 1980 more than 1,000 reporters covered that primary, most of them working for the television networks. White remembers flying back to New York City from Montana late one night in 1960 with Jack Kennedy and a man from the *New York Times*, just the three of them talking all through the night. "You can't do that today," he told *Omni*, "because now a television camera has to be on the plane intruding all the time."

Having recently published his final volume of the prize-winning series on American politics, *America in Search of Itself: The Making of the President 1945–1980*, White blends two themes. He chronicles the upheavals that altered U.S. political life in the 35 years leading up to the election of Ronald Reagan in 1980 and the struggle of ideologies and personalities that gave that election its historical significance.

White was born in Boston in 1915, attended the famous Boston Latin School, and went on to Harvard, from which he graduated *summa cum laude* in Chinese history and languages. It was as a Sheldon Fellow of Harvard that he set out on a round-the-world tour in 1938 and paused in China, where his career as a journalist began.

Today White claims that *America in Search of Itself*—a summary of his political and historical wisdom—will be his last book. At this time, then, it seems appropriate that *Omni* ask this most illustrious of American political analysts to look toward the future and the changes that are so rapidly transforming the nature of politics in America. *Omni* interviewer and correspondent for the *Washington Post* Thomas O'Toole (who has also coauthored with Marvin Cetron the book *Encounters with the Future: A Forecast of Life into the 21st Century*) interviewed White in his country home in the rolling hills of western Connecticut.

*Omni*: One thing that comes across in all your books is the degree to which America has changed in the last four decades. Tell us what kinds of change you see by the year 2000.

White: The biggest change in the last twenty years has been the changing of American politics by television. That means basically the big networks. Technically, the subtle refinements of demography and computer analysis have totally changed politics. Old-fashioned politicians flew by their wings and felt the wind blow. The modern pol doesn't fly by his wings. In Connecticut, for example, Prescott Bush pulled out of his race with Lowell Weicker for the Republican Senate nomination. The polls showed that he could defeat Weicker but that the Democratic candidate, Toby Moffett, could beat him. Twenty years ago that wouldn't have happened. Bush would not have pulled out so soon.

Now what intrigues me the most is what I see as the coming collapse of the big television networks. Cable is going to change our lives and change politics. For example, you'll watch a debate on interactive cable and press the buttons at home to tell the politicians who won. You can even tell the pols whether you thought the candidate gave a good answer or a bad one. You'll have a society in which everybody's instant reflexes can be registered and coded. I think it's disastrous, but I don't think it can be resisted. In New York City there is now a cable channel on which only Chinese is spoken. There is also an all-Spanish cable. You're going to get an Italian channel, a Jewish channel, and certainly a Polish channel. In every area there will be a channel that's precisely aimed at a specific audience. Let's say you're Italian. You pitch your message to an audience that wants to listen to opera. You give them *Aida* and *Madama Butterfly*, and you'll get a big Italian audience.

Television is where politics takes place today. It's how you manipulate the issues. Nobody ever heard of a dish antenna ten years ago, but the dish and the direct-broadcast satellite will compress time and break America down into its factions and groups in ways we can't imagine. Maybe you won't have to tune in any longer to the evening news. Maybe you'll just press a button and get a ten-page printout of what happened that afternoon. Politicians are going to talk to a bigger and bigger audience all the time through television. I don't like it much, but you can't rail against it and you can't stop it.

*Omni*: You've talked about technical and substantive change. What social change do you see?

White: The thrust of women in American politics, which has just begun and which in the next twenty years will reach dimensions we can't perceive today. I think the makeup of Congress will still be predominantly male, but in every small town where a first selectman is paid between three thousand dollars and ten thousand dollars a year, I believe an awful lot of women are moving into local politics. We'll find our towns and suburbs will be governed by women to an extent that I can't imagine, nor can I perceive the consequences. One quarter of the members of the New Hampshire state legislature are now women. That proportion will grow to half or maybe even two thirds by the year 2000. That's something we're going to have to adjust to. Thank God, women have the same kinds of quarrels among themselves as men have.

*Omni*: What's going to happen to America's cities? Is life in the cities as bad as it's made out to be?

White: For the past twenty years this country has tried to confront the problems of

the cities and has failed totally. Right now the cities are being evacuated. St. Louis has lost twenty-seven percent of its population in the last decade. I see New York City shrinking from a present population of seven million to probably five million by the year 2000. I see St. Louis and Boston shrinking to populations of three hundred thousand or even less. Chicago will lose population too. We're going to have to rethink the function of the cities. Cities can no longer support themselves. The tax base is eroding. We must have a constitutional amendment by the year 2000 to provide federal support for city services. Our cities will be like Paris or London, where the financial burdens are assumed by the central government. All London provides is cops. It doesn't provide hospitals. New York, Chicago, Boston and St. Louis provide hospitals. But cities can no longer afford to do this.

***Omni:*** One thing you have often said is that the politicians you met in other countries were too committed to ideologies instead of to the people whom they were supposed to serve. Well, we now have our own ideologue in the White House. Is this the start of a trend? Is the United States turning to ideology?

**White:** Yes, it is. Ideology is going to become more and more important. As people become locked up in the industrial bureaucracies and all the other bureaucracies they will have less control over their own lives. So they become more vulnerable to ideas. The one thing that will frustrate or reverse that trend is a progressive federal system. You may have an ideologue in Washington—and there'll probably be more of them—but there will be enough stubborn, recalcitrant states that will go against the dominant ideology. But let's rule out a flat answer to your question.

Between now and the year 2000 we're going to go through some unexpected turbulence of the kind we saw in 1963 and 1968 that will change and shape the ideologies current today. Take nationalism. I think that by the year 2000 the United States will be far more nationalistic, self-centered and protective of its own interests than it is today. This sort of nativism will spring up, I think, first in the Midwest—in the foundry states—because the Japanese, the Germans, and the French are slowly undermining the guts of American industry. Most of the cars sold in America are now foreign-made. I do not want to see our steelworkers and auto workers put out of work because Taiwanese and Japanese labor can work for one half our average wage.

Free trade really means that the standard of living of the rest of the world must rise and ours must be lowered to equalize it. Ideologically that's the most humanitarian idea there is. A Korean steelworker works for one third the wages that an American steelworker earns. But I don't want to see the American steelworker reduced to the living standard of a Korean steelworker. That may sound selfish and

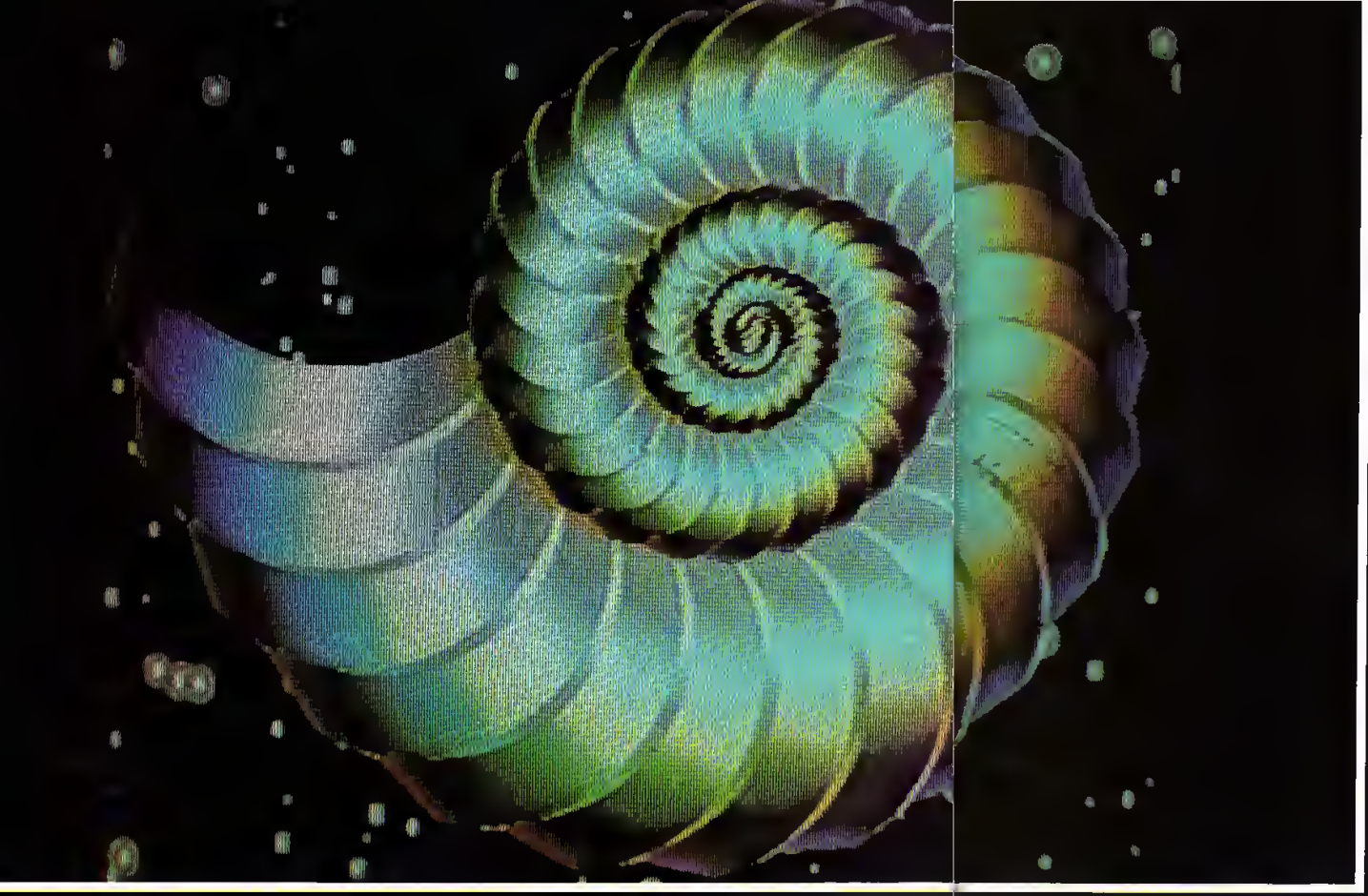
CONTINUED ON PAGE 120

*A Japanese artist explores the world of computer graphics as an electronic microcosm for evolving new flora and fauna from surprisingly simple logarithms*

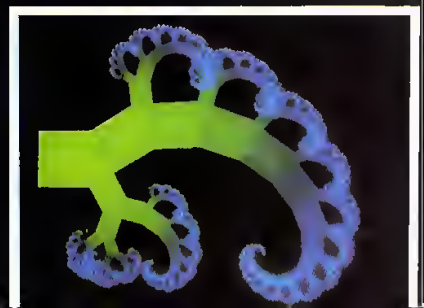
# KAWAGUCHI'S SPIRALS

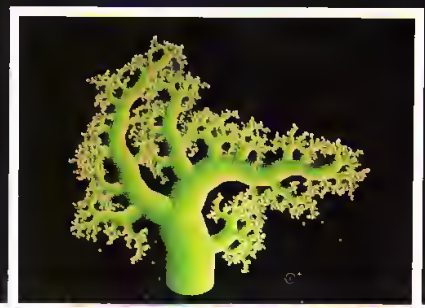
BY KATHLEEN STEIN

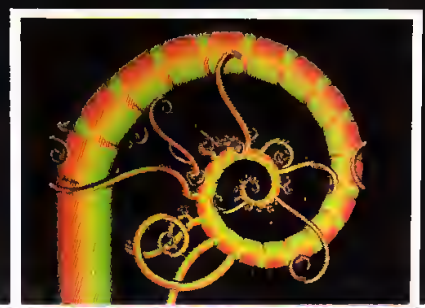
Spiral formations are perhaps the most perfect shapes in nature. Since way back the spiral has been the symbol of life's infinite generating force, and, following the lattice steps of DNA's double helix (from the Greek *helix*, for *spiral*), we return to our origins. Spirals appear early in the chain of animal evolution. Cilia, worms' gills, fly larvae, and some shark-egg capsules have them. The cochlea in the ear of every mammal is screw-shaped, from the human heart's base the fibers of the ventricles run in spirals in the muscular contraction of the systole. Some magnetic currents are spiralesque, and there are the galactic whirlpools of the nebulae. Scientist Sir John Leslie noted that the logarithmic, or equiangular, spiral exactly resembles the form and elegant septa of the *Nautilus pompilius* shell. So, too, did a thirty-year-old instructor at Nippon Electronics College, in Tokyo, who found that the 3-D animating potential of the computer was an exact medium for examining the spiral's morphological principles and for creating shocking new entities based on organic growth patterns. Yoichiro Kawaguchi grew up on Tanega, an island south of Kyushu, where the pellucid quality of the sea is matched only by the richness of its shell and coral life. His design, consequently, is dominated by the spiral forms of marine animals as well as by the curved

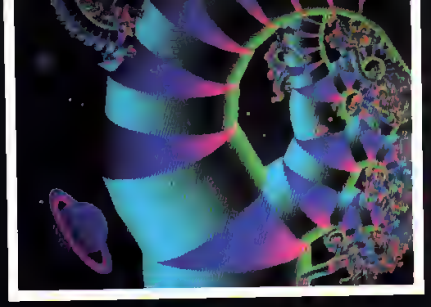


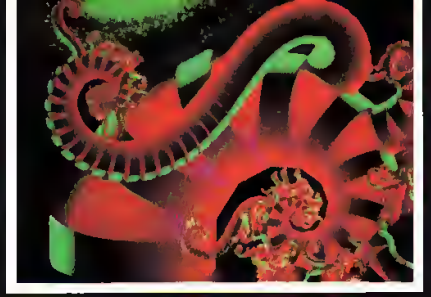
*Above: Computer-generated ammonite, a Mesozoic fossil shell representing a near-perfect logarithmic spiral. Right: Young plant, coral, and tendril.*

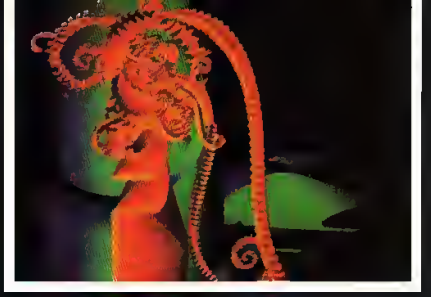




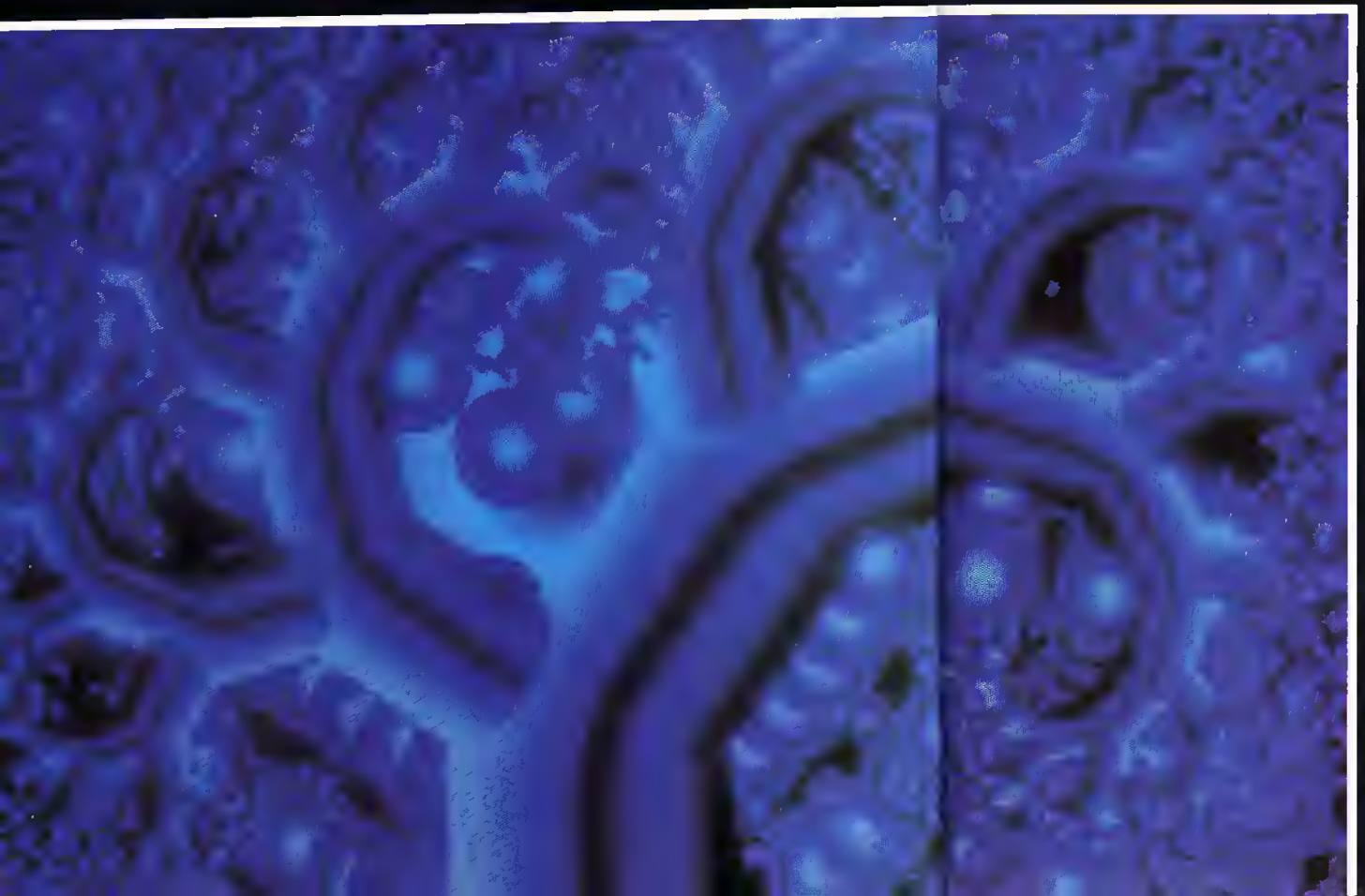








*Right: Details of hypothetical plants show how small variations in algorithms can create different "organic" forms. Below: Close-up of a single-spiral organism*

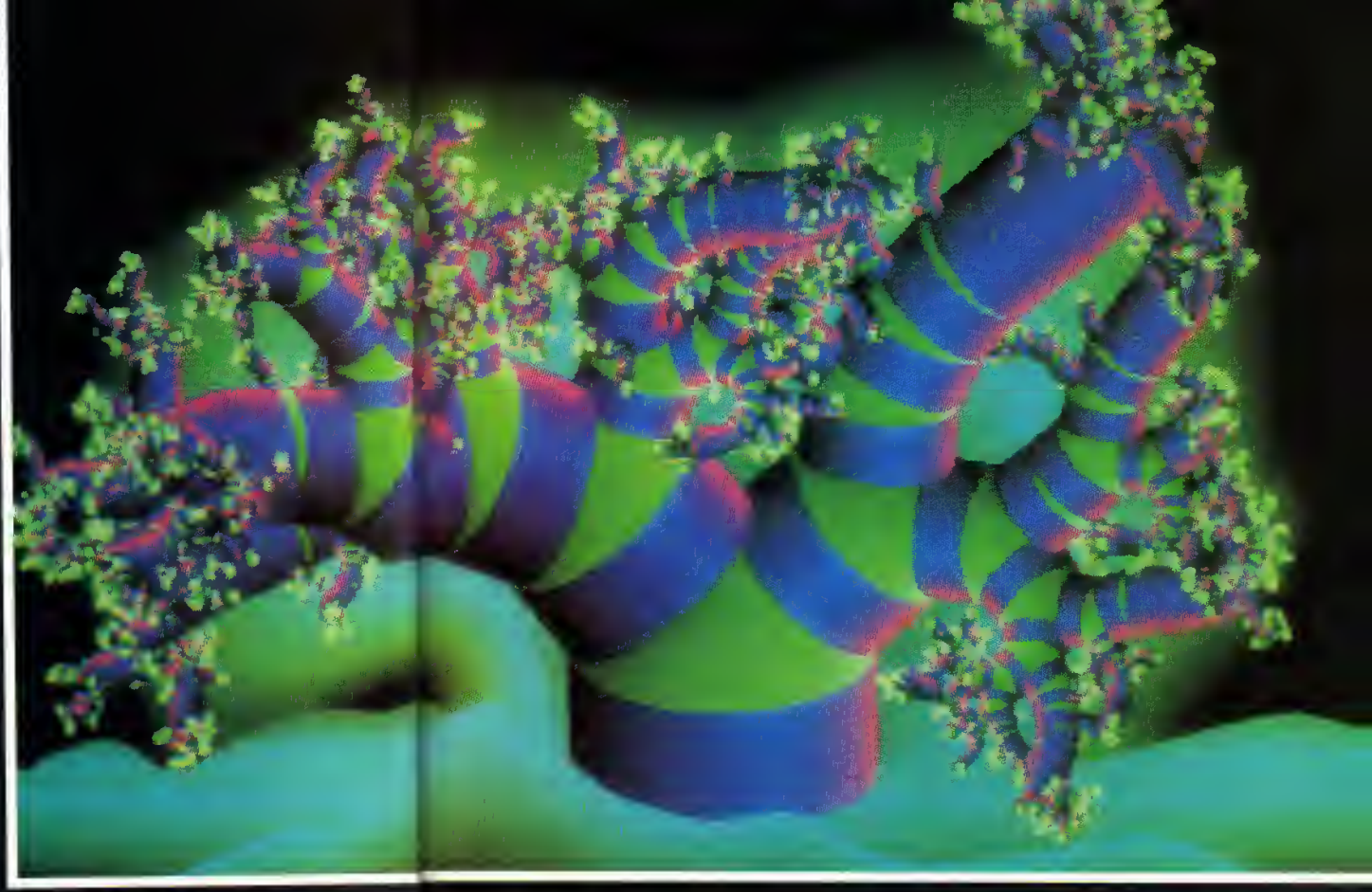


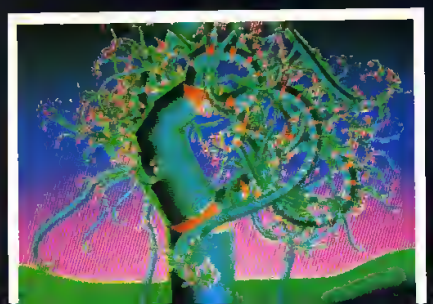
shape of horns, fangs, claws, and plant tendrils. "To create these new forms automatically," he tells us, "I built a software of mathematical expressions." His paints, brushes, and canvases are his FORTRAN language, the E&S Picture System II and Melcom 700 graphics system for generating line drawings, and an Advanced Electronic Design 512 and a Micro 11/23 for the phantasmagoric solid-shaded images. It requires a few hours now to generate a new brachiopod or spirogyra. The basic element of Kawaguchi's "morphological foundation algorithm" is the single chamber, described in the computer as a polyhedron with similar top and bottom bases, one larger than the other. Kawaguchi calculates the growth rate of the polyhedra, including a "width equation" to determine the widening or narrowing thickness of the stalk. He describes rules for the inclination, or slope, the direction of the twist, the "gentleness," or curve, of the spiral. "If the angle is big," he says, "the growing shells twirl rapidly." He causes "phyllotactic mutation": Branches sprout automatically (via an equation) from branch-forming "knots," programmed to germinate between the cracks in each chamber. "Several methods can be used to calculate the position of each knot. I have applied the most basic theorem of geometry—the Pythagorean theorem of the right-angled triangle." Pythagoras himself predicted, Kawaguchi cryptically adds, that this theorem would someday be used to create "living" geometric forms. Simulation of plant growth is the same as that of shells, but it contains further parameters for proliferation. When the length of a branch becomes

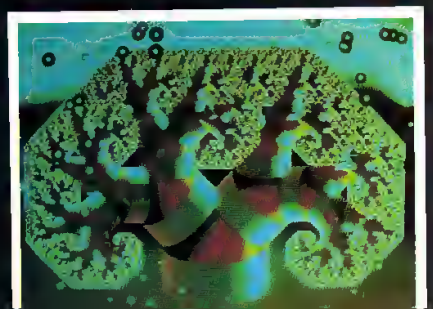
*"Generating these shapes, which might consist of millions of faces, is an application of biology."*

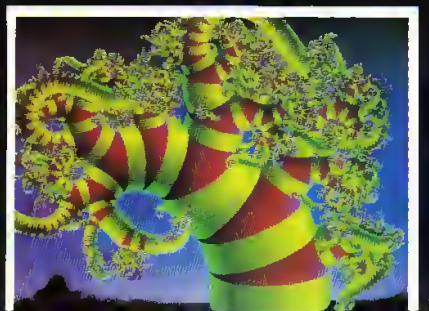
*"These principles can be used to re-create plants that died millions of years ago or to predict future life"*

smaller than one pixel (the smallest element in the grid of the computer screen), the branch stops growing. In nature the spiral curve of plants is determined by sunlight and gravity. In Kawaguchi's rarefied world, a plant generates new tendrils by equations for self-multiplication. "If we change the value of the self-adjustment power," he explains, "we get a plant with more complex curves and branchings. The process for generating these shapes, which themselves might consist of thousands or even millions of faces, is an application of biological and mathematical principles of branching." Kawaguchi speculates that these principles might be used "to re-create life that died millions of years ago or to predict life that may grow millennia from now. And we might hypothesize plants that grow in weaker, or possibly even artificial, gravities." Kawaguchi's designs have evolved from precise naturalistic studies to Gorgonian artifices—products, perhaps, of an overly fecund botanical imagination, determined to seed these monstrously mutated flora on unsuspecting horizons. But the artist is modest about the detailing; he employed algorithms developed by other Vermeers of the computer to remove hidden lines and surfaces. The hot, bright colors were supplied by simple programs. The backgrounds were programmed separately and synchronized into the spiral compositions. Today Kawaguchi is giving birth to new morphologisms conceived by secret equations. He intends to demonstrate the growth of highly irregular bodies in terms as precise as "those that indicate the erratic orbit of a comet."









*Above: Plant-coral composite growing on a heavy-gravity planet. From left: Complex quasi-biological shapes are simulated by many repetitions of one equation.*

# AUGENBLICK

CONTINUED FROM PAGE 72

"You've got a fucking cure-all, and you're sitting on it. Why? To use as some kind of club? A carrot? A bribe? Is that it?"

Dave looked down at the chimp, which continued to pound on the plastic, using both fists now. The chimp wasn't happy.

I edged around so I could see Dave's face; the chimp wasn't the only one not happy.

That was it. Political. It made me feel ill.

"Dave, how far away are you from full-scale testing?"

"We can't be sure. You understand how these things—"

"Guess."

He turned away from the chimp and looked at me. "Probably we won't ever go full-scale."

"What?"

He sighed, and I remembered a little girl with leukemia. *Will it hurt?* I remembered a woman who died horribly in spasms. I thought about my own sickness.

"There are reasons—"

"Bullshit, Dave." I stared at the chimp, then back at Best. "I know some media people," I said, holding my voice even. "You know how ferretlike a Wallace or Rivera can be if they think a government agency might be giving the public the shaft."

"You don't want to talk to them, Rick."

I stared at him. "You want to give me one good reason why not?"

He sighed again and nodded.

Then he gave me a reason.

The patient was a thirteen-year-old girl in for her first pap smear. She was nervous, shy, and I was being very gentle with her, using my best professional warmth as I explained what I was doing and why. She responded well, relaxing, and I felt a small sense of pride that I could put her at ease, that I could help her. I was a good doctor.

I finished the manual exam and watched Thompkins help the girl into the diagnoster. The lid fanned slowly down, and Thompkins stepped back and smiled at me. It was a compliment, her smile.

I returned the expression, but it was reflexive. I was remembering yesterday, standing in a cold and sterile biolab nine floors above this one, listening to Dave Best.

"Our society is geared for sickness and death, Rick." He rubbed at his forehead with his right thumb and forefinger. "Sure, we've always been pushing the last two horsemen back, since the first witch doctors, but this—" He glanced at the cold case. "This is a gigantic leap. Too big on a wholesale scale. Think of the problems it would create."

"Yeah, a few morticians will go out of business," I said bitterly.

He shook his head. "It's more than that, and you know it."

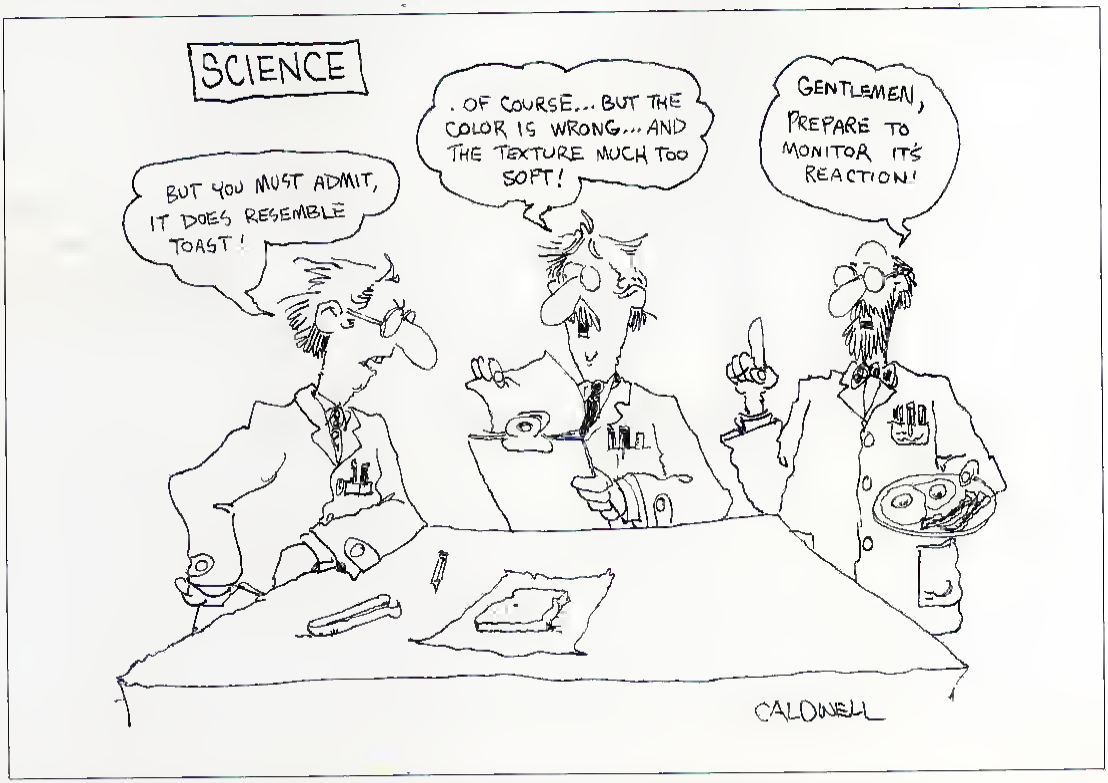
I thought about it. He was right, of course. It wouldn't be just a few morticians. There'd be a big effect on hospitals, doctors, pharmaceutical companies, and medical-supply houses. Then there were things not directly involved with medicine, like food, overpopulation, jobs, housing. A hundred things would suddenly become more complex. A thousand things. Once word got out, there'd be no limiting the drug to just the terminally ill. Everybody would want it. Who could blame them? A lot of problems, but they were social, not medical. Not mine. I started to tell Best that, but he spoke first.

"We know about your radiation neuropathy, Rick. You hid it well, but we know." He paused and looked straight into my eyes. "We can put you on the drug. You saw what it did for the President."

That cold wind that sometimes blew through the hollow crags of my soul had a brother, a warm, gentle breeze touched me, pushing away the weight I'd carried all my adult life. To be cured! *We can put you on the drug.*

My voice came out in a whisper when I managed to speak. "And if I refuse?"

Best shook his head slowly. "I asked them to let me talk to you, Rick, because we've known each other so long. Because we're friends. You really can't refuse, Rick."



I looked at the disposal perched above the stainfree sink on the nearest wall.

Best saw the look. "No," he said. "But you could be transferred to one of the ice-locked camps in northern British Columbia. A camp so primitive that outside communications are severely limited. A permanent transfer, until your disease catches up with you."

I swallowed dryness.

"Or you can keep quiet, go to work for Research, and the drug is yours. Balance dying in some backwater hole with your career shot against maybe living to a hundred thirty or a hundred forty in perfect health. Think about it."

The diagnoster's *ching* sounded, and Thompkins helped the teen-ager from the device. I looked at the girl and smiled. "Everything is fine," I said. The physical was normal, and I was sure the diagnoster would agree. It wasn't worth the few extra seconds of tension she'd have to wait for electronic confirmation. I could save her that anxiety.

An image of a five-year-old child who'd sat on my exam table washed over me, a ghostly memory behind the older girl.

*It wouldn't matter,* I told myself. *It wouldn't come in time for her, no matter what I did.*

*But what of the others? Those thousands dying of things we couldn't do anything about before?*

*We could do something for them now. I could do something.*

Thompkins led the girl out into the dressing room, leaving me alone with my thoughts.

They were watching me, monitoring my calls, I knew. But I might pull it off if I were fast enough, devious enough. I could call in my favors, agitate things, shed light on their little secret. Maybe it was my life against uncounted thousands who would live if the adaptogenic became generally available. A fair bargain.

I thought about a young woman with a shattered glass in her clenched hand, dying.

If I took the deal, I could just pretend to go along, play their game, but chip away from the inside. Yes, I might be able to do more good that way. I would have to give up my practice, go to work for Research, sell out. It would look that way, but—

I would be alive.

These were my choices. Take the big risk, stay true to my principles, go out like a hero, do something worthwhile. Or do the sensible thing. Swallow my high-minded indignation, accept their rationalizations, and play along.

I took a deep breath and reached for the phone on the exam-room wall.

"Hello?"

"Hello, Dave." I took two more long breaths and let them out slowly. "This is your newest member of Research."

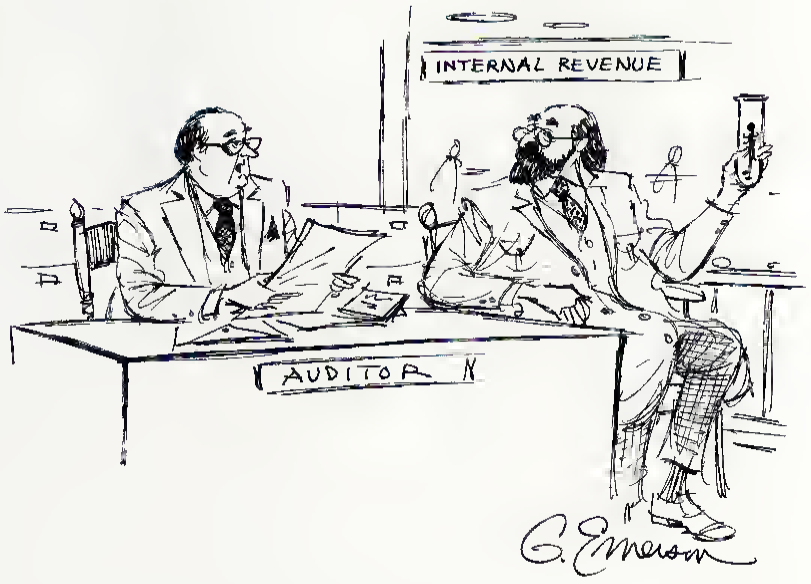
I could almost see his smile. "Glad to hear it, Rick." He sounded more relieved than glad. I got a definite feeling we were conspirators, schoolboys sharing a smutty joke, as if I had vindicated him somehow. I had sold out, therefore, it was okay that he had, too.

I nodded dumbly, staring at the gray wall. I had a bitter taste in my mouth, and I was glad there were no mirrors in the room. I didn't want to see myself now; my *Augenblick* might somehow show me another truth I didn't want to know.

I needn't have worried about mirrors. I found out a week later. As I passed the RadRoom, I saw the old man, the one with Bern's disease. I had taken the adaptogenic. I was cured, but he wasn't. The radiation therapy was last-ditch, experimental, and a waste of time. He still had his fatal sickness, only—

Only I couldn't see it. I strained, tried to bring it out, but my *Augenblick* wouldn't work. As an ordinary observer, I could see the man's jerky motions easily, but my talent was gone. I felt cold and hollow, and I knew it really was gone this time.

I turned away from the old man, and I would have laughed if it hadn't hurt so much. The one thing that had made me special was no more, and I knew with a gut-level certainty why. The adaptogenic had cured me of it. ∞




*"I don't care whether you created that life form yourself. You still can't take it as a deduction."*

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nationalistic, but I believe a resurgence of some kind of nationalism, particularly in our trade policies, will be a critical issue in the late Eighties, throughout the Nineties, and into the twenty-first century.

Ideology is a way of looking at the world, and the way we've looked at the world is a hangover from World War II. I loved the Marshall Plan because it put Europe back on its feet and preserved freedom, but I don't think we should have supported the rest of the world the way we did. That's our hangup—that we are responsible. One reason why the Japanese surrendered was that they had no more food. The biggest problem was, Could we ship enough food to Japan? We didn't went the Japanese to starve to death, and we didn't let them starve. I think that assumption of responsibility has run its course.

***Omni:*** I trust you don't mean we're going to turn into a nation of jingoists.

**White:** All of the future politics of the United States will be framed in terms of a changing outside world. This world no longer belongs to us, and the sooner we decide that, the better foreign and domestic policies we'll have. The whole Third World is in revolt against the myth of the nineteenth century. We have become the favorite target of the Third World. I think we would do better to pay less attention to the Third World, less attention to its demands on us, and more attention to our own economic and social needs. In other words, our own national interests. I cannot see why we're involved in the problems between Namibia and Angola. Most people are bored with the problems in El Salvador, Pakistan, and India, and it might be much better if we were less excited about the Middle East. Peace might come earlier if we said, "Fight it out among yourselves."

That goes also for Japan, Taiwan, and China. We are not responsible for keeping the garment workers in Taiwan and Hong Kong alive. We are responsible for keeping the blacks and Puerto Ricans of New York City alive. Those are our people who are being put out of work by garment workers in Seoul, Taipei, and Singepore.

***Omni:*** You wrote in your latest book, *America in Search of Itself*, that you met only one president who could qualify as a hero, John F. Kennedy. "He changed things," you said. Are there no more heroes? Have all the American heroes died?

**White:** I see nobody onstage right now. A hero, by my definition, is someone who changes things—someone who feels in his gut what's bothering ordinary people and who can express it. Abraham Lincoln was a hero. He knew slavery was a bad thing, and he expressed it in such noble language that people went to war over it. Winston Churchill was a hero. "Blood, toil, tears, and sweat." "We shall never surrender." He expressed exactly what the people felt. Such a hero, I'm sure, will come along as soon as we can define the deepest issues. Kennedy did a good job on the environment and on the Test Ban Treaty, but he did a bad job on the Bay of Pigs. He suffered because he was Catholic and Irish, and he opened the door for Catholics and Irish to enter American national politics as equals. Do you realize that, when he took office, only four Catholics had ever achieved Cabinet rank in the United States? He opened the door for everybody, and the people who surged through were the blacks. He put the wheels under the Civil Rights Act, and in that sense he pulled the country together. There were two black congressmen when Kennedy became President; now there are seventeen. There will be more.

The heroes we'll see in the future may be negative heroes, but they'll be heroes nonetheless. The budget is a very poor playing field for heroes. Very few people understand the budget process, but it is totally out of control. The two greatest issues of the next ten years are going to be social security and an influx of immigrants. I have a ninety-two-year-old mother. Without Medicare to help her out, I would be bankrupt. Social security and Medicare take care of her, but social security also takes so many bucks out of a paycheck that it's crushing the average workingman. Somebody heroic will have to come along and speak out for a reasonable social justice. Who that will be, I don't know.

***Omni:*** How do you tackle the question of social welfare in America? Who gives and who gets?

**White:** We are going to have to choose between sense and reality. We're going to have to decide what parts of the social security system and the welfare system we must retain. Old age pensions we have to retain. Medical care we have to retain. What parts can't we keep? It costs New York City twenty million dollars to equip its buses with lifts for wheelchairs. The Metropolitan Transit Authority says there are only two handicapped people in wheelchairs who ride the buses every day. The Association of the Handicapped says the Transit Authority is wrong; that there are ten people. If there are ten, that's two million dollars a person. With that kind of money you could have limousines taking those ten people to work.

Reagan is the first president in thirty years to say, "We can't keep all the promises we've made." Whether he's right or isn't about the issues he's seized on, the country will have to make a decision about which promises it must keep and which promises it cannot keep. You can't have a federal government sending three and a half million people to college every year and state governments sending God knows how many to state universities. When you get to that point, you have to say, "Which kids will go to college and which won't?"


*"I think you're healthy enough to withstand the trials and pressures of four years in the White House, but I absolutely forbid you to campaign."*

*Omni*: The Northeast appears to be losing its political power and the Sun Belt looks as if it's winning. Who will the winners and losers be by the year 2000?

**White**: I'll give you two states. I've covered both. West Virginia is one of the richest states in the Union. It is the greatest coal province in the world. Hard coal, soft coal, coking coal—any kind of coal you want—West Virginia's got it. It's got timberland, fresh water, limestone. For some reason, the leadership of West Virginia has never gotten off the ground. Now let's take a look at a state with no resources whatsoever and that's New Hampshire. Granite and the Merrimack River—that's all. New Hampshire has. New Hampshire has fewer resources than Switzerland. And it's very much like Switzerland. There's been a kind of leadership. It has developed an industry that makes it one of the most vibrant states in the Northeast.

The demography of the country baffles me. The richest foundry area in the world is the Midwest, centered upon the Great Lakes. There's coal in Pennsylvania, Ohio, and Illinois, there's iron ore in the Mesabi Range in Minnesota, and there are those great waterways linking them. It's the best place in the world to make steel and manufacture automobiles. If present trends continue, however, the Midwest will be the biggest power loser. California is headed for big trouble. That state has great farmland and great universities, but I think it's due in the next ten years for the kind of trouble that New York has experienced in the past ten. It doesn't have the water, and it's overpromised.

I think the big gainers will be Texas, Louisiana, Alabama, Tennessee, and some other states in the Southeast. They have oil and gas, great waterways, and an entrepreneurial spirit that hasn't been paralyzed the way it has in the Midwest. Leadership will come to the Southeast. The South has had a basically very greedy leadership. It has done more taking and less giving, but the leadership will come.

New England won't suffer. Connecticut has a higher percentage of its people working in defense plants than any other state in the Union. This tiny state makes most of the helicopters in the United States. Pratt and Whitney, in Hartford, makes jet engines for the Air Force. Electric Boat, in Groton, makes nuclear submarines. Avco Lycoming makes engines for new tanks, and the whole Housatonic River valley still makes firearms, rifles, and bullets just as they've done since Valley Forge. New England lives on its brains. I don't see that changing. New England's greatest resources are Harvard, Yale, MIT, Lincoln Labs, Woods Hole Lab. So long as New England sustains its universities, I can't see that part of the country losing its present weight in American life. The Midwest and the cities are the places in trouble.

*Omni*: You revolutionized political reporting with your first book about the electoral process in 1960. What's going to happen to political reporting in the future?

**White**: Political reporting is so sophisticated these days that my 1960 book now looks primitive to me. How will it change? There will be increasing rivalry between the television reporters and the Gutenberg reporters—the pencil pushers like you and me. I think the Gutenberg reporters are going to revolt. They're going to stop going to the press conferences where the cameras dominate things. I don't think you can get a reasonable answer from anybody in public life who knows he has to cut that answer to ninety seconds.

Newspapers will become more and more the domain of the elite in American life. Thoughtful people will read, and everybody else will watch television. Any newspaper that attempts to compete with television for its audience will dwindle, decay, and pass away. Newspapers began in eighteenth-century London with the *Tattler* and the *Spectator*, addressed to thoughtful people who wanted to know what other thoughtful people were doing. This all means there will be fewer and fewer pencil reporters and more handsome faces appearing on television.

But it's our very numbers these days that keep us from getting as close to the news

as we should. I remember flying back from Montana to New York with John Kennedy in 1960. There were three of us on the plane—a man from the *New York Times*, Kennedy, and me. We talked all through the night, just the three of us. You can't have that anymore, because a television camera has to be on the plane, intruding all the time.

*Omni*: Do you think that the primary election process and the nominating conventions will be significantly different by the start of the next century?

White: The primaries are now so crazy that they can't get worse. The political parties must come back to a more sensible way of selecting candidates for the executive office. The nominating process may have to go back to what it was in the beginning, to Congress and congressional caucuses. Some states are becoming very unhappy with the primary system, because it bypasses party politics. I think the primaries will be cut down to size. You may still start in New Hampshire and wind up in California, but you won't have to go through thirty-five states in between. The primaries are now a testing ground for political athletes—the guys with the best glands, who can stay up the longest, who can go the farthest. I think the present primary system forces a candidate to make so many contradictory promises to so many groups with so many special interests that he's bound and tied by these promises before he gets elected. I think there should be fewer primary dates, reasonably staggered through the calendar year, like four dates a year.

The biggest thing you haven't asked about are the political action committees. They were designed to give people a chance to speak on issues. But the solution has now become the problem. Every major candidate—I suppose Reagan was the first to do it—now has his own PAC to shunt money around to delegates and local congressional races to buy loyalties. Money is the pollution of the system, and it has gotten beyond control. I think I would abolish the PACs entirely. Big business, individuals, and cause groups have more loose money to put into campaigns than ever before. It's dangerous. It's especially dangerous in the primaries, when these PACs can swing a vote and then come into a convention with delegates they own.

Let's turn to conventions. They should become smaller. Three thousand delegates is a mob that can be controlled more easily than you can control six hundred. I'd like to see them go back to a [less controllable] convention of maybe a thousand people. I think there were twelve hundred when Kennedy was nominated.

I haven't seen a convention since then in which the nominee was in doubt at all. What's happened to conventions is what's happened to primaries—the end of party rule. The speeches should mean something. There should be some party responsibility. Eventually the whole primary and convention process will have to be regulated by a federal act, which it should be. People say that Congress shouldn't get into party politics, but Congress always does.

Congress should set the dates of the primaries and fix the numbers of delegates. The present primary system will collapse of its own weight. The Democratic convention of 1912, when Woodrow Wilson was nominated, and the Democratic convention of 1932, when Franklin Roosevelt was nominated, were far more deliberative bodies than the present conventions, and they got us two damned good presidents. There has to remain the infusion of grassroots delegates, which the primary is not about. It has to be balanced by people of responsibility and authority.

*Omni*: One thing we haven't talked about is the racial composition of America, which is changing all the time. What are Americans going to look like in the year 2000?

White: We used to think of the United States as a white country with ten percent blacks. By the year 2000 this country will be only seventy percent of European origin. The rest of it will be of Caribbean, Asian, or African origin. We've begun to absorb the fact that the Hispanics are already here. We haven't begun to absorb the depth of

the migration from Asia. Perhaps the fastest-growing group is the Asians. They are also socially the most upwardly mobile. American-born Japanese and American-born Chinese have the highest standard of living and the highest incomes of any ethnic group in the United States. They have a fierce thirst for learning and for skills. They will be governors, senators and representatives in the year 2000.

Let me say one thing about immigration. Sooner or later we will have to declare how many people we want to accept every year. Whether we take two hundred thousand or two million, we should stick to the rules. We have to set an immigration total. Then comes the much harder task of defining within that total—from which countries we want to accept new citizens.

We haven't talked much about blacks. Much of what happens to blacks depends on what goes on in black family life. One thing going on in the black community is the enormous increase in middle-class blacks entering mainstream American life. Then there are those who are not being absorbed—who are living in deteriorating social conditions. We used to use the phrase *unwed mothers*. We now use the phrase *single parent households*. Whether these single-parent households can get their children to school, keep them there and move them up through the educational system is a problem we'll face in the next ten years. There will be more blacks in Congress. I see a doubling of black congressmen. I'm not sure whether we'll see any more black senators. We may see several new black governors, especially in polyethnic states like California, New York and Texas. I do not see a major candidate for the presidency emerging from the black community.

*Omni*: Whom do you see as candidates for the presidency in the year 2000?

White: I may be able to discern a woman vice-presidential candidate or a black vice-presidential candidate, but I cannot see either party nominating a woman or a black for the top slot on the ticket. I see no Golda Meir or Margaret Thatcher on the American scene—not now and not in the next twenty years.

*Omni*: Look at the future of the world for a moment, especially the threat of nuclear war. What are your thoughts on the nuclear-arms race?

White: I think we will build our nuclear arsenals until we're broke and never use any of the weapons during the next twenty years. I can see a nation like Iraq or Argentina trying to set off an atom bomb and being squashed instantly. I cannot see a major nuclear confrontation. It's like poison gas. The poison gas used in World War I was so horrible that in the sixty-five years since that time no country has used poison gas in war. I do not see a nuclear holocaust involving the two great powers. There may be an incident in which the two great powers get together and quash the minor power, but that's as far as it will go.

*Omni*: American supremacy in technology is over—at least in some regions of high-tech. Where do we go from here?

White: Other nations may get ahead of us in one area or another, but I can't see any nation overcoming America's lead in innovative technology in the next twenty years. If we maintain our universities, no body has the wealth of university research that we do. In space exploration, I can't see any other nation silly enough to waste so much money on a wild idea that may not actually pay off. I cannot see Japan or the Soviet Union establishing an outpost on the moon before we do. Notice I said "outpost" and not "colony." If the space station works and space is found useful, other nations may put an outpost in space. There won't be any colonization of space. Nobody wants to go and live there.

I want to make one last point. The real problem of American politics in the year 2000 is how we're all going to get along together—all our different kinds of communities. We've been working at this thing for one hundred years, and we're approaching a point where it's no longer so simple as it used to be. We have to get along with one another. The big question is: How are we going to do it?

## COMPUTER KIOS

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gan in 1961 when a bank donated to the school an old Burroughs LGP-21 machine roughly twice the size of his desk. Mostly it was used to perform some of the more mundane administrative tasks, drawing up absentee lists and keeping track of report cards. Once Sensky recalls with some satisfaction, he also used it to catch a graffiti artist known only by his spray-painted moniker. "Fred 169." Serisky simply asked the computer to call up all the students with the first name Fred and all students with 169 somewhere in their street address. The list produced six suspects. From there, catching up with the perpetrator was an easy matter.

Since then, Serisky has used the machines for far more libertarian work. In 1964 he managed to procure for the school a new Olivetti computer. By then he began to worry about the possibility that the computers would become elitist tools. Traditionally, the first children who got to use them were the gifted math students. Other students should learn how to program computers, too, Serisky thought. So even though Francis Lewis is situated in a predominantly white, middle-class neighborhood, Serisky made an effort to recruit nonwhite students. "As a coach goes after football players," he explains, "I went out to get black kids for the computer courses. The first two minority kids who came here are now in science—at Harvard."

Today it is impossible to get a diploma from Lewis without some exposure to the terminal, much the way it is impossible to graduate from other high schools without English composition. Computer languages like BASIC, FORTRAN and COBOL are all taught at Lewis. It is assumed that every student has at least a minimal amount of computer literacy so that when one needs some information about a college, he is expected not to bother the guidance counselor but retrieve the data himself from the computer.

Much of the education with computers at Francis Lewis still emphasizes math heavily—a student can get the equivalent of ten years of math training if he wants—but computers are used in social studies, the sciences and even the business department. In social studies, for example, students get a civics lesson in guns and butter when they play a program known as HMRABI (for Hammurabi), adapted from a games program written at the Digital Equipment Corporation. In HMRABI the student becomes the leader of ancient Babylon and, through the mediation of the computer, conducts trade in arms and distributes wheat to his minions. He remains in power as long as he is popular—that is, as long as his decisions on trade and arms produce a strong military, adequate food supplies and a stable economy. One wrong move, however, and there is a peasant revolt, ending in the leader's going into exile.

Educators everywhere are initially inclined to reserve this kind of computer education only for gifted teen-agers, but this bias is changing. Thanks to pioneering experimenters like Seymour Papert, a professor of mathematics and education at Massachusetts Institute of Technology, we are beginning to shed the misconception that computers are only for older kids who are "good in math." Papert, an innovator in education, studied with the noted Swiss child psychologist Jean Piaget, and it was he who developed an ingeniously simple language called LOGO that lets kids begin programming computers virtually before they can read.

As a result, the machines are becoming more accessible to other age groups. For example, elsewhere in Queens, Halsey Junior High School has a very progressive curriculum in which thirteen- and fourteen-year-olds regularly demonstrate their skills at school science fairs. At one recent show, Sergio Rico, fourteen, displayed an elaborate program he had written, explaining the earth's hydrological cycle. It was complete with graphics and a multiple-choice quiz. Another student, Sujee Danesh, only thirteen, prepared a display depicting blood flow through the human heart.

The architect of the Halsey computer curriculum that produced these kids is a young, energetic ex-engineer named Howard Weinman, who finds teaching much more rewarding. "Unlike us, these kids are growing up with the machines. It will be natural for ideas to come from their work with computers. Next year," he says, beaming, "we start kids programming in BASIC. I'm extremely envious. I didn't have these opportunities."

Children even younger than those of junior-high age are getting, or will soon get, these same opportunities. At the Lamplighter School, a private institution in Dallas, children ranging in age from three to nine are learning LOGO on a battery of computers as part of an experimental program, a collaborative effort of the school, the Texas Instruments Corporation, and MIT's artificial-intelligence laboratory. And by the start of the academic year next fall, the New York Academy of Sciences will begin an experiment in New York in which children in first grade and kindergarten will be exposed to computers.

As educational tools, the computer and the LOGO language have also demonstrated spectacular potential among autistic children and those with learning disabilities. For example, at MIT a team of educators reports working with a thirteen-year-old whom others had written off as retarded. Today he is programming computers with the skills of a professional.

And though it may seem farfetched, the computer has even had positive effects on so-called bad kids. In Downey, California, Larry Bauder, a computer-store owner, has been working with tough kids from the slums of Watts and East Los Angeles since October 1981 under the auspices of a group called the Los Angeles Committee for the Transformation of Street Gangs. Every Saturday, from 11:30 A.M. to 3 P.M., about a dozen kids from the ages of ten to seventeen spend their time sharpening their skills on Commodore computers (on loan from the company) that Bauder reserves for them in his store.

"Even after twenty years as a teacher," Bauder says, "I'm still amazed at what happens to the so-called dummies when they sit down in front of a computer. For one thing," he notes, "they learn how to read. Some are functionally illiterate, but if they want to learn how to play Star Trek, they learn how to read."

He has been optimistic ever since he tutored his first group. After only four months of lessons, Bauder claims that four inner-city girls he trained are fully qualified to run a computerized office. "They really take to the computer," he says of all the kids he has taught. "I have to kick them out of here at three o'clock." Bauder now hopes the next step will be to move computers into Watts and East Los Angeles.

One reason for the universal appeal of the machines among the young is that the kids have a much healthier attitude about the computer than many technophobic adults do. "My parents see the computer as something that's going to take over the world. I see it as a way of expressing myself," says Jason "Bucky."

Though children who visit the Marin Computer Center, in Corte Madera, California, take to the machines eagerly, the staff there discovered that some sort of acculturation course was necessary for adults to overcome their biases. "They think the machines are just waiting to embarrass them," says director Mary Cron of parents who visit the center.

Two educators, David and Annie Fox, founded the Marin Center in September 1977 with their own money. Its basic premise is that children should be exposed to the wonders of computing. Cron says she herself is the least likely person to guide such an institution. She admits she was skeptical of the computer as a teacher, and thought it would merely spew out prerecorded information with no opportunity for student-teacher interaction. Now she views the machines as important additions to the classroom. "A computer can't replace a teacher, but it can free him or her to do more quality work," Cron says.

The Marin Center's basic programming teaches youngsters "sequential" thinking,

computerese for simple logic. More significant, the computer has inspired dramatic improvements in the performance of many so-called slow learners. Many of the children who need remedial instruction begin computer courses with the idea that the machine is smarter than they are. But the quick discovery that it's really a stupid device that needs to be told what to do makes them comfortable with it.

So far the kids who have dominated the headlines are the wizards who seem to have been born in front of a video display terminal, like Stephen Bacchus, who at the age of thirteen was the youngest freshman ever admitted to New York University. Bacchus is heavily into advanced calculus, but he's also done programming on the past performances of racehorses. One program he wrote for his Commodore Pet microcomputer has come up with a number of winners, and Bacchus is proud that his machine's handicapping ability is decidedly more advanced than his father's. Now Stephen is building a robot.

Eugene Volokh, who has a fair amount of entrepreneurial skill, started his own software firm, VE Soft, and has worked as a consultant with Hewlett-Packard for several years. He's written a program for the company's HP-3000 computer that now sells for $1,500. "Eugene knows more about the HP-3000 than just about anyone else," says Clifford Lazar, Hewlett-Packard's manager of systems development and sciences. Much of this Eugene did while working on an undergraduate degree in mathematics and computer science at UCLA. He is now fifteen years old.

These are the stars, the superachievers of tomorrow. It is likely that they would be precocious even without computers. But in the future thousands, perhaps millions, of average youngsters will be using the machines in more routine ways. And they will not have to worry about becoming computer-adaptive the way most adults do right now.

Steven Senzig, an independent programmer and computer-store owner, puts it this way. "The kids who are now four, five, eight, ten years old will learn how to program just as you and I use the telephone. They're going to be downright scary to old types like us who weren't raised that way." As a result, when Senzig opened a computer store in Lansing, Michigan, he wasn't surprised to find as his first customer an eleven-year-old who had diligently saved the money for a computer from his earnings as a newspaper delivery boy.

There is also a dark side to this fascination of the young with computers. Many kids have cajoled their parents into spending their hard-earned savings on a microcomputer, the price of which can run from a few hundred dollars to well into the thousands. Even then many of these kids often cannot afford to buy the expensive software (the programs, usually recorded on tape cassettes or magnetic discs, needed to run the computers).

Rather than write their own programs, kids will often pirate others—despite the elaborate protection codes that have been put into them—in disregard of copyright laws. Right now a program for microcomputers known as Locksmith is a best-selling item among the young computer users. Locksmith amounts to a sort of skeleton key that can break through the protection codes of a great many software programs. The kids in effect use it to copy programs illegally, much the same way you might use your cassette recorder to tape a friend's record album.

Greg Trautman sees some personal irony in software theft. "Ninety percent of the programs used by my friends have been copied, but I hope this changes. Stealing programs adds to the high cost of software. And," he adds, "I'd like to write and sell software."

As computer usage has become more pervasive, so, too, has widespread "crashing" (sabotaging) of central data banks. Sometimes it is done out of pure avarice; sometimes it is merely a prank. A few school kids in California tapped on to their school's computer records of its grading system and programmed it to give themselves As. They gave everyone else


*"In the name of Creationism . . . go back!"*

F's. In a more malicious vein, a couple of years ago two Chicago area teen-agers broke into DePaul University's main computer system via a computer-telephone hookup and shut it down during registration week. Authorities didn't realize their machine had been sabotaged until someone noticed a threatening message that appeared on a computer terminal: "If you don't give us a mixed-assembly software program, we'll shut you down again."

That same year some industrious youngsters from the Dalton School, an exclusive private school in New York City, patched into the huge electronic files of a data-systems firm in Canada. The culprits—four thirteen-year-olds—managed to erase one fifth of the computer's memory before they were apprehended. The case became a *cause célèbre* among security experts and computerphiles because of the high degree of sophistication involved in doing this.

It may be several years before we can assess the full impact of computers on society, because children have only just begun using them. "Computers are still new and there's a lot of confusion as to what they are able to do," explains Ann Lewin, director of the Capitol Hill Children's Museum, in Washington, D.C., which has 30 Atari microcomputers in its Future Center. "It will take about a decade to tell what kind of effect the use of computers will have on education."

But already the effect of computer technology on the young is the focus of controversy among adults. Many conservative communities are complaining that kids are becoming "addicted" to video games and spending most of their time and all their lunch money on them. This is probably an overreaction. Bright kids like Trautman, Carey David and Sujee Danesh do spend after-school hours at the local pizza parlor playing Tempest and Centipedes, this year's replacements for Pac-Man and Space Invaders.

The games are entertaining and provide a way to escape from the pressure of growing up. But the kids understand that computers are merely computers. They have learned the programs, and they respect the work that went into formulating these programs. Children are doing just fine in putting the computer in their own perspective. Jason Bucky says: "If I'm feeling bad, I'll go home, switch on my TRS-80, and kill a few Xylons."

"I've been amused that towns are trying to outlaw video game arcades," Ann Lewin says. "I'd rather see them playing games than doing drugs."

Trautman, the whiz from Queens who's desperately trying to trade his Radio Shack TRS-80 for an Atari 800, makes another observation. "Have you ever been to the Penn Station arcade at three o'clock in the afternoon? It's all businessmen in suits playing video games. Then he adds, "Well, I guess it's better than having them hang out in bars." OO

# TINKERING WITH UTOPIA

*Paradise or techno-nightmare ahead? Six scenarios for our future*

BY MICHEL SALOMON

We are living in the expectation of the third millennium, a time of messiahs or one of apocalypse just as our fathers lived through fear and hope of the second millennium. Therefore, our time is a particularly favorable one for prophets, diviners, and fortune-tellers of all sorts, as well as more scientific futurologists. The prophets, the seers I consulted on just what kind of future we were preparing for ourselves in the next millennium, were six of the most distinguished scientists in their fields, which included everything from brain research and biochemistry to the behavior of men and animals. What new world does brain-control expert José Delgado see ahead for us? How did Konrad Lorenz, Nobel Prize winner and ethologist, see the human of the twenty-first century evolving? Each has his own well-reasoned opinion of how close, or how far away, a science-created utopia is.

Already for the 1980s experts speak of such breakthroughs as an implantable nuclear-powered heart that can survive its owner and be reimplanted in another, an artificial pancreas automatically dispensing insulin to diabetics, a small electronic brain stimulator to ease chronic headaches, to allow paralyzed persons to regain the use of their limbs, and, in some cases to modify the behavior of mentally ill persons. In the field of immunology experts predict that "smart spheres" covered with antibodies would attack specific cancer causing or infectious cells without harming any others. Contraceptive methods for the near future will range from a monthly pill for men and women to a contraceptive vaccine now in experimental use, and apparently successful, in India.

For the Nineties the possibilities are even more dazzling. There is talk of artificial wombs in which fetuses can be kept alive until they are ready for birth, of synthetic blood, of procedures to detect blood clots, the cause of heart attacks and strokes, of computer implants for the brain that can boost physical or intellectual performance, and even cloning of multicell organisms.

And for the year 2000 scientists have forecast such things as using hibernation to extend human life by intermittent slowing of the body processes, the synthesis of plant and animal cells into a new species (called the man-plant chimera) through the fusion of cells, and for shortly after the millennium—between 2000 and 2050—memory correction, the prolongation of virility, and

PHOTOGRAPH BY BILL LONGCORE

a life expectancy without major failings of our health or faculties prolonged until the age of one hundred twenty

Are these hollow dreams or mad scientists illusions? Just restricting our attention to the discoveries that have already been made, there are enormous ethical dilemmas facing us. None of our laws, our religions or our ideologies have prepared us for this new world

The purpose of these interviews was to get future projections and an analysis of their implications from some of the most famous men in science today. In order to maintain some homogeneity in these interviews done with scientists of such different cultural backgrounds and disciplines, I worked from a single set of questions. Not all those interviewed answered all the questions. Not all of them participated in the psychodrama of anticipating a utopia. Some even rejected giving out any scenario for the future on the grounds that it smacked of sensationalism.

That did not matter. The questionnaire was only to serve as a set of guidelines and these were not intended to be interviews in the strict sense, but long talks in which these men were asked to envision the future and to discuss fields in which they have a special competence. I found it especially exciting to compare their various attitudes. Some are optimistic, some deliberately dark, even apocalyptic.

Listen to these men with me.

## NIKOLAAS TINBERGEN

In 1973 Nikolaas ("Niko") Tinbergen shared the Nobel Prize for medicine and physiology with Karl von Frisch and Konrad Lorenz, the two other eminent founders of the then-new experimental discipline of ethology, which studies animal behavior and attempts to apply its insights to human behavior.

Like his brother, Jan, a Nobel Prize-winner in economics, Nikolaas Tinbergen is in his own words a "concerned citizen" of the world whose natural pessimism is tempered by his hope to see man, that most predatory of animals, arrive at the threshold of civilization and experience cooperation, conviviality, and harmonious existence within the ecosystem.

*Do you believe in the future of science in general and sciences of life in particular? Are we heading for a better world?*

Yes to the first question, no—for the near future—to the second one. I hate having to say this, but I feel that it is no use glossing over my conviction that while science may help us to think more lucidly and to see more clearly the predicament we as a species have created for ourselves, those who govern us will never be willing to act on this growing understanding. What seems to be clear is that as we recognize, and begin to tackle, the many symptoms of an ecological and social illness we have brought upon ourselves, the very remedies we apply create more new problems than they solve. I become more convinced that our predicament is getting worse, literally from day to day.

*What you are saying seems too desperate. The world population appears to be stabilizing, and creative scientific efforts offer some hope that we will find substitutes for fossil fuels and other nonrenewable resources.*

With respect, I have to disagree. It is only in the affluent countries that we see a flattening of our population curve, and even this may be temporary. In Africa, Asia and South America the numbers of people are still growing fast.

And we need not disagree about the seriousness of the scarcity and hence the cost of energy, nor about the terrible dangers of pollution. We know, for instance, that our refuse dumps all over Britain have deadly poisons in them that will trickle through into our drinking water. We know that no safe way of disposing of our nuclear wastes has yet been devised. Yet we continue poisoning ourselves and our children and grandchildren. Science may know some answers, but man is still going foolishly for short-term profits.

> "Unless we change our way of life, I see no future for mankind. It looks very much as if we are an evolutionary freak, a mistake that can live only a short time."

*And what if, for example, we have no other choice than to "go nuclear" as a means of producing energy?*

We may well have a choice, to begin with. We must learn to live on a lower level of affluence. I think this is imperative. The psychological obstacles are difficult to overcome, though. Now that we have our color TVs and our cars, we won't voluntarily give them up. Also, the livelihood of millions is now dependent on the manufacturing of these goods. Yet we will have to reorient our technological efforts, and we have the technical potential to do that.

*Is it not utopian to fancy a possible radical change in our society without using coercive methods?*

Yes, it may well be. That is why I am so pessimistic. We may have to be autocratic. Even when the leaders are initially benevolent, this leads to dictatorship, which one cannot get rid of anymore. Benevolent and wise dictatorships just are not stable. And democracies are too slow, even powerless as long as the voters are not educated in these issues.

*But you belong to the school of the most pessimistic futurologists. The optimistic ones believe that mankind will find a way out of this mess. If we are too numerous, we'll colonize the oceans. We'll neutralize nuclear dangers, find raw materials, and develop new nutritional sources, thanks to biology and chemistry.*

You find this kind of irresponsible optimism only among the unintormed, and among those scientists who do not look beyond their own often narrow field of competence. Anyone who reads what the admirable World Watch Institute records about the many aspects of population, the depletion of resources, and pollution will know that there is only one justified conclusion. Unless we change our ways drastically and very soon, disaster on an unprecedented scale will happen.

*What about the possibilities raised by genetic engineering?*

I do not believe in its constructive power. I think our adaptability is of such a complexity and so poorly understood that the fact of playing around with our genetic endowment is likely to produce irreparable disaster. Apart from this, who should have the right to decide on what is a better genetic heritage for our species? Nobody must be allowed to play the part of God. I think that the applications of genetic engineering will be restricted to very limited, isolated tasks, such as rendering a parasite harmless or perhaps constructing better antibodies against certain diseases.

*There remains the possibility that the genetic genie may help us fight illnesses and increase our food and raw-material resources by biomass. Isn't that something we should explore?*

Such limited applications may well become even more important than they already are, but let us not try to create a supposedly better world by genetically changing man while we have not even tried to adapt him to his present environment or to adapt our environment to our real needs. Let us start by controlling populations, sparing our resources, and reducing pollution. Every new technology creates some advantages, but often disadvantages as well, which have to be corrected by another technology. That is an endlessly proliferating set of chain reactions. The conquest of malaria leads to a population explosion, the overdose of antibiotics to the appearance of resistant strains of parasites, and so on.

I repeat. Unless we change our way of life, I see no future for mankind. It looks very much as if we are an evolutionary freak, a mistake that can live only for a very short time. The human race has existed no longer than a couple million years, a geological second. Even that may appear prolonged, compared to the remainder of our span

KONRAD LORENZ

First come the dogs ; two four half a dozen which welcome the visitor at the gate of a somewhat ramshackle mansion, standing lopsided in a large park. This is Altenberg, a small village on the Danube riverside one hour by train from Vienna. Heavy chest and white flowing beard, hustled by his dogs, fussing around, smiling and apparently utmost pleased with the noisy affection of his dogs, here comes the lord of the manor, Konrad Lorenz.

Later on, the Altenberg patriarch will show me his fishes, which he is studying now in a huge aquarium worthy of Disneyland. To my regret, the famous graylag geese are not there. They have been penned some 100 kilometers away on a Danubian island. But after a search one might eventually find some tortoises, snakes, and other impediments belonging to the wonderland of Lorenz, ethologist, poet, physician, philosopher, and somewhat of a wizard.

*Here's a question just tailored for you. How do you see the man of the twenty-first century? Will the population explosion many predict make him more aggressive?*

I do not know whether man will become more or less aggressive. Our studies on fish show if the fish are uncrowded, you will have a minimum of aggressiveness; then at a certain crowded state the aggressiveness reaches a maximum, which decreases again if you crowd them still more. So it is not certain whether greater density will damage humankind by creating more aggressiveness, but it would quite certainly cause other very serious harm to humankind.

More worrisome is a technocratic explosion that would mean every man gets a narrower and narrower field of knowledge in which he must be an expert in order to compete with other people. It's the old joke about the specialist who knows more and more about less and less and finally knows everything about nothing. The small slice of expertise that a man masters would fill up his time and tax his learning capacity to such an extent that he would have no time to learn about anything else. And that, in my opinion, is one of the greatest dangers of urbanization and the population explosion we see today.

*You mean everyone will have to be satisfied with fitting into a shoebox?*

Exactly. More than aggressivity, what I fear is the growth of bureaucracy, parceling, overspecialization.

*Is living a hundred twenty years possible? Is it to be wished?*

Yes, yes. I am seventy-four years old. Even with my arthritic knee and my walking stick if I am not otherwise changed, I would like to live one hundred and twenty years just to see what happens. Of course, one hundred and twenty years should be the norm, that is, you would get your retirement at one hundred instead of at sixty-five, and you would retain your youthful creative power until you are seventy. Under these conditions, it would be perfectly desirable to live very much longer. The human brain already collects a great deal more knowledge than we can use in our too short lives.

*As for sexuality tomorrow, in a world of contraceptive vaccines and test-tube babies, will conception and sexuality be totally dissociated?*

God forbid.

*The process is on its way. We have the test-tube baby, and in America they're experimenting with having someone who is not the mother bear the child. All this with the best intentions.*

Hell is paved with excellent intentions. The dissociation, for the sake of scientific efficiency, of the feeling of love and natural reproduction belongs with genetic control and manipulations, artificial insemination, and so on.

We must not forget that the sense of values, of all that makes for good and beauty, is genetically fixed. We do not know at all how it works. So by controlling natural selection and the natural choice of partners, we might do a lot of harm by this dissociation. For instance, falling in love only makes sense together with a certain degree of monogamy, because if you beget children promiscuously, there is no sense at all in loving the most beautiful and the most intelligent person among your acquaintances. It will be possible to dissociate love and sexuality, but this would be highly dangerous to humankind.

*Will man be able to control his own body biologically by means of tiny computers? Is it to be wished?*

It is feasible, but I believe it is not desirable, because all those things that allow for control over one's body should be in the hands of only those very clever persons who know how to use them and what they do. So far, our natural biological mechanisms, which have proved their value through a long evolution, are more to be relied upon than all these inventions.

*So many miracles are expected from our new understanding of biology that this discipline is already seen as being able to solve all our problems.*

Why not? Under the condition that we are able to control exponential growth. And here we go again. This new technology may temporarily solve some problems while in the long run speeding up the process of catastrophe by encouraging population growth. One of my friends, an economist in San Francisco, told me that all of today's threats arise from overpopulation and that the solution of this problem is education and nothing else. The more I think of it, the more I realize that this is true.

You cannot require a man from a developing country who is worried about his rice crop to avoid using DDT. You cannot tell him that DDT, in the long run, kills everything. He would not really understand it. You cannot expect a starving Pakistani or Indian to understand that our Western fat

*"It's not that I don't love you, Richard. I just don't want to be around when you reach critical mass."*


*"Two Spielburgers to go '*

is not the most perfect happiness

Education of human populations implies first of all some equality in the standard of living As long as there are people starving, you cannot ask them to stop using pesticides nuclear energy, and God knows what This means that we should avoid using them as much as we can

JOSE DELGADO

It is significant that one of the most impressive neurologists of our time José Delgado has his laboratories at a hospital complex in a Madrid suburb named after Santiago Ramon y Cajal the noted Spanish physiologist who won the Nobel Prize in 1906 for his research on the functioning of the nervous system

Built in the past decade Cajal is the newest hospital in the Spanish public health system It has 1 700 beds is an ultramodern building and for Delgado and his international team of researchers provides 9 000 square feet of laboratory space spread over three floors

As in the huge American university cum-medical centers, there is a research facility grafted onto a complex modern hospital Delgado administers a large budget and oversees six units (histology physiology neurochemistry bioelectronics computers and veterinary medicine) composed of 50 researchers who turn out 100 publications a year—some such as those on brain stimulation, of a degree of sophistication unavailable elsewhere

Delgado is one of the more flamboyant scientists of our time Many people remember—because they were so striking—his experiments using electrostimulation of the brain with fighting bulls and his studies of dominant monkeys in colonies For years no popular article on brain research was complete without a photo of Delgado, with the simple pushing of a radio-transmitter button stopping a charging bull—with a unit called a stimoceiver wired to its brain—dead in its tracks And in experiments with monkey colonies he put a stimoceiver button in their cage enabling a group of monkeys to dethrone their aggressive leader Any time their leader attacked them they could push the button, and it sent a pain signal to the leader's brain punishing him for his aggressive activity In time the leader became one of the meeker more submissive animals I was naturally curious about what his work with animals meant for us humans

*What will happen with your continuing stimoceiver experiments?*

Minicomputers of the future will be utilized to a greater extent in many fields, including brain stimulation Brain activity recognized by a computer would trigger radio stimulation of a second inhibitory brain area which can block the original recorded brain wave Let us suppose that a computer were programmed to recognize the onset of an epileptic attack or other undesirable conditions It could then trigger excitation of another cerebral point and

arrest the unwanted activity

By making use of the refined equipment already available we will be able to treat problems in the future and avoid, for example, unnecessary medication that affects many organs not just the point of origin of the specific problem. Patients would no longer have to suffer in anticipation of dreaded attacks. Before they were even aware of an incipient crisis, the computer would recognize the warning signals and initiate appropriate treatment.

*Your ideas about having a computer direct human health or behavior sound rather frightening. How can you explain this to the general public?*

The goal of modern medicine is to treat precisely and exclusively the malfunctioning area and permit the patient a normal and unhindered life. Until now much medical care has been based on such treatments as administering medications that may have adverse effects on organs not involved in the problem, or surgery, which eliminates malfunctioning parts of the body that cannot now be repaired. In the future interference with the whole organism and general trauma should be more effectively avoided. This represents the liberation of man from anxiety, from the unwanted side effects of medicine—a dream for the future, but one that can be realized.

*In your own field of study what is it that you want to achieve? Many people, in spite of your charm and genius, see you as the father of the school of manipulating, normative behavior.*

Let me just say two things. First, you are right: my personality, and especially my work, have been misinterpreted not only by the mass media but by some scientists. Second, the reason for this is that they feel the danger of someone who knows too much and therefore could manipulate their own minds. The purpose of my research is exactly the opposite. It is very difficult to get this idea across. If I say that human beings are robots, automatons, what I am trying to do is irritate people, to awaken them so that they can escape the robotization of human behavior. If you realize that there are many elements that determine your own behavior, then you can and should encourage the development of intelligence and individual freedom.

*Are you predicting that we will experience a kind of mental revolution?*

It is possible, although perhaps utopian, like all hopes for mankind. Thinking for oneself requires a lot of energy and effort. It is easier to follow the masses and do what one is told. If instead we train people to evaluate information, give them alternatives, give them weapons and techniques for mental self-defense, they can become actively involved in the development of their own psyche, which I call psychogenesis. The discipline of psychogenesis should give the individual awareness of his own mental powers and mechanisms and therefore greater freedom. Psychogenesis should be taught like geography or physics, but it is even more important because it can help each person to be more of an individual. You could do exercises to control your mind. You should be taught how to leave your mind blank, how to concentrate deeply, how to block out unwanted noise, how to control your emotions. You should be taught to avoid unnecessary mental suffering.

*Doesn't this mean a whole new curriculum must be developed?*

No, only the addition of a new subject, which is perhaps the most interesting—a practical, personal application of biology to improve the functioning not only of your body but of your mind also. Therefore, the possibility to self-educate and free yourself from unnecessary constraints of civilization and the environment. To encourage individual freedom through biological knowledge. This should be a main goal.

ERWIN CHARGAFF

In his admirable book *Heraclitean Fire*, which is at once an autobiography and the record of a scientific and philosophical journey, biochemist Erwin Chargaff describes himself when he entitles one of his chapters 'More Foolish and More Wise.'

In the story of his life there are many episodes that were dramatic and sometimes droll. He was driven out of Vienna, where he had been born, by the threat of a Nazi seizure of his country. Like so many others, he came to the United States, where he resumed his experiments and began to teach at Mount Sinai Hospital and Columbia University in New York City. Beginning in 1949, Chargaff described certain irregularities in the composition of DNA that he formulated as the concept of "complementarity," also known as Chargaff's law. A little later he demonstrated the "pairing of bases," which is one of the crucial indications that the DNA molecule has the structure of a double helix.

Although the final description of the structure of DNA won James Watson and Francis Crick the Nobel Prize in 1953, it could just as easily have been earned by the inspired but some say unlucky biochemist from Vienna.

*Is it possible to live one hundred and twenty years? Is it even desirable?*

Where is the limit? Methuselah lived nine hundred years. To live one hundred and twenty years seems to me possible, but it's not desirable under present day conditions. If we were living in a Golden Age, perhaps, but right now I don't believe that will really arise because in one hundred twenty years we'll be living in caves. Somewhere in New Zealand there will be a residuum of humankind that will survive irradiated and unhappy.

*Yet the fields of gerontology and geriatrics are flourishing.*

In my opinion a good many scientists are nothing better than swindlers. I have little confidence in them or their work.


*"I'm afraid your condition is terminal, Mr. Fishbein. It's unlikely that you have more than one, good fiscal year left!"*

*What about euthanasia? Could it under sociopolitical constraints be part of a new morality tomorrow?*

Certainly! If we don't have the atomic bomb, we'll have to regulate the world's population one way or another. But is euthanasia really a problem? I doubt it. I think that when it comes to morality and science my anxiety lies elsewhere—in a certain form of perversion of contemporary science and a rape of nature.

There is probably a limit that we should not have passed or transgressed, marked by the two nuclei. One is the atomic nucleus and the other is the cellular nucleus. One might say that Greek atomism marked a limit for human intelligence. That limit has been exceeded in my time, starting with World War II, by the fission of the atomic nucleus and the splitting of the cellular nucleus. I belong to the patient generation, people who observed and contemplated nature. The scientists who were my predecessors wanted to know without doing, whereas today modern scientists want to do without knowing. They are not interested in the attentive contemplation of a reality, but in changing it. It's a rupture, a truly revolutionary intervention that has taken place in the relations between science and nature.

*People hope for so many miracles from the new biology that some persons are already talking of that discipline as one that will yield answers not only to our therapeutic problems but to our other needs of tomorrow. Do you believe it will?*

Right now nothing permits me to predict a happy future for pathobiology. That future is rather a humbug. We are all under the influence of publicity. Everything is exaggerated, and we should forget ninety percent of what we hear. That goes for the other sciences as well, because they are only, I repeat, a means of existence and survival for the scientists. Their caste has become so big and influential that it has created its own code. As for the biologists' promise that wood, gasoline and steak will tomorrow be replaced by the products of biogenetic manipulations, allow me to take that with a big grain of salt.

*When you discovered the structure of DNA, did you know what you were doing? Were you aware that you would be involved in the beginnings of what you consider a demon, genetic engineering?*

No. It was between 1947 and 1952. I'm one of those prophets who should curse themselves for the evil they've done without knowing it. I'm a chemist, and that interested me as a problem to solve. I knew that DNA contained, in a form as yet not determined, the principle of cellular specificity. But in any case I didn't foresee what would happen as a result of my research, because I was too isolated, too wrapped up in my own problems, which had more to do with the philosophy of nature than with its structure. I approached chemistry like a philosopher rather than like a scientist.

*You knew that your work would involve the essence of living matter. Didn't that bother you?*

No, because I've always made a distinction between understanding nature and explaining it, which is at a level that is much less important and much more facile. I wanted to understand what would be good for the mind, for the human brain, because understanding nature is a boon.

Explaining or utilizing nature is already ambiguous. The serpent in Genesis was not of my opinion when he said, "Ye shall be as gods, knowing good and evil." I thought that to understand was good but that to utilize was equivocal. Consequently, I never would have studied the problems that are now the basis of genetic engineering. I'm only sorry that this interview didn't take place twenty years ago.

## HENRI LABORIT

Henri Laborit is the most brilliant "maverick" on the French intellectual scene. Born in Hanoi in the French colonial days, Laborit abandoned a military career in "la Royale" (the French navy) first for a surgical career and later for basic research. He introduced into therapeutics the first tranquilizer, chlorpromazine, and artificial hibernation and in 1957 he received the prestigious Albert Lasker Prize, sometimes called the "little Nobel," from the American Public Health Association. Laborit has taken a particular interest in organic reactions to the experience of aggression. He has also tried to extend the structural law of general biology to the social sciences and has written a number of books and articles that deal with human behaviors in social situations.

Laborit has published some 20 scientific works and done more than 700 original experiments. He is also the founder and publisher of the international journal *Agressologie*. He is not only an internationally known scientist but a talented writer and, recently, an avant-garde filmmaker.

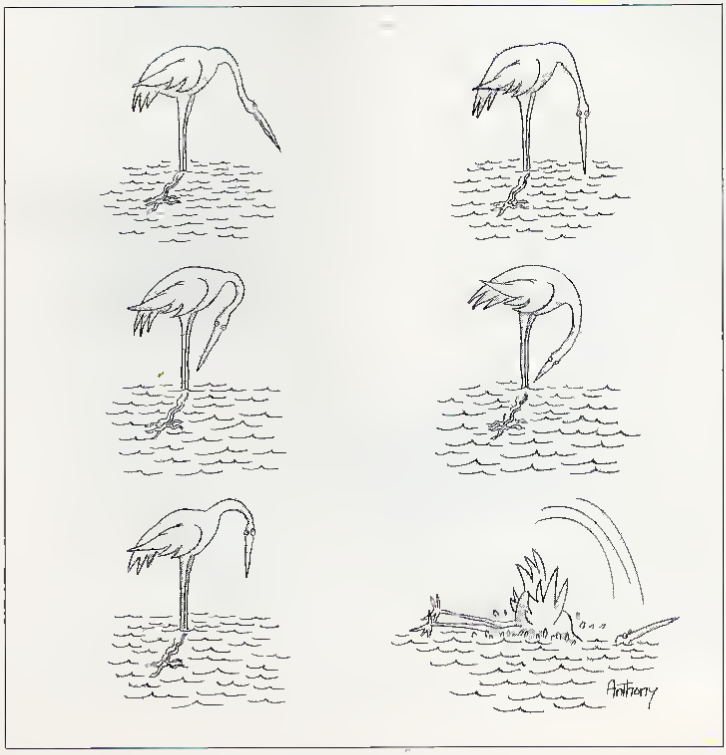
As I said, he is a maverick.

*You're no doubt aware of the futurist utopian tables drawn up by solid scientific institutions. In your field scientists have predicted the control of aggressivity and memory, the improvement of the brain's capacity to analyze and learn, to increase its sexual appetite and even bestow such curious things as a deeper awareness of the beautiful. And all that before the year 2000. Is this science fiction?*

No, not at all. I think it's amusing and, for the majority of those predictions, within the realm of the possible. But I don't believe in the social advantages of pharmacology. I don't believe that man will transform himself in a lasting way with drugs. It's by knowing himself and not by using a crutch molecule that he will succeed in that.

*So one of the fathers of modern psychotropic drugs is disowning his children.*

No, I'm not disowning them. Let's say that I'm revitalizing them. There are pa-



tients who given the present state of our knowledge cannot get along without those drugs and derive great benefit from them. Obviously a maniac with criminal obsessions needs pharmacological treatment. No logical discourse can be expected to touch him or bring him back to a normal level of awareness and self-control.

*If, tomorrow, man is better able to understand himself, will he be better for all that? In other words, do you see the man of the twenty-first century as less aggressive and more convivial?*

As regards the man of the twenty-first century, I don't know what he will be or will not be. He will be what a complex of elements of infinitely numerous factors make him. In the matter of human behavior, futurology is extremely difficult. I would say only that mankind is an animal species like the others, and that, as such, it will perhaps disappear. If it survives, it will do so because it has found a new mode of behavior and will have halted its suicidal march and its permanent aggression against itself and the biosphere.

*You are one of the pioneers of modern psychotropic drugs. Does man have reason to fear that his free will, his freedom, will be definitely alienated by the new psychotropic drugs?*

People have nothing more to fear because they are being manipulated every day without psychotropic drugs. Throughout the day man is made into what is wanted by those who govern our societies. Man is manipulated from his infancy and throughout his life. He is inculcated with notions of good or bad, what he should do to be rewarded, what he should not do to avoid being punished—notions that for that matter vary from one period and region to another. One doesn't need psychotropic drugs to alienate or to be alienated. The mass media suffice since they are in the hands of the powers that be.

*What of the new biology? People expect so many miracles from it that some of them believe it will provide answers not only to our therapeutic problems but to the nutritional, energy, industrial, and other needs of tomorrow's world. Do you believe it will?*

I'm distrustful of the new biology, because I'm aware that the manipulation of living matter can induce unexpected and sometimes grave disorders. I'm thinking of Egypt, whose industrialization took the form of the Aswan Dam. The decision was made, and the dam was built. But the result was an ecological disaster on the great scale associated with an unprecedented diffusion of bilharziasis.

Since then I've been very prudent. The manipulation of living matter, of natural cycles, can lead to such a boomerang effect. Yet biology can contribute considerably to the solution of energy and nutrition problems. We must simply be prudent and keep a critical and lucid watch on what may appear to be progress.

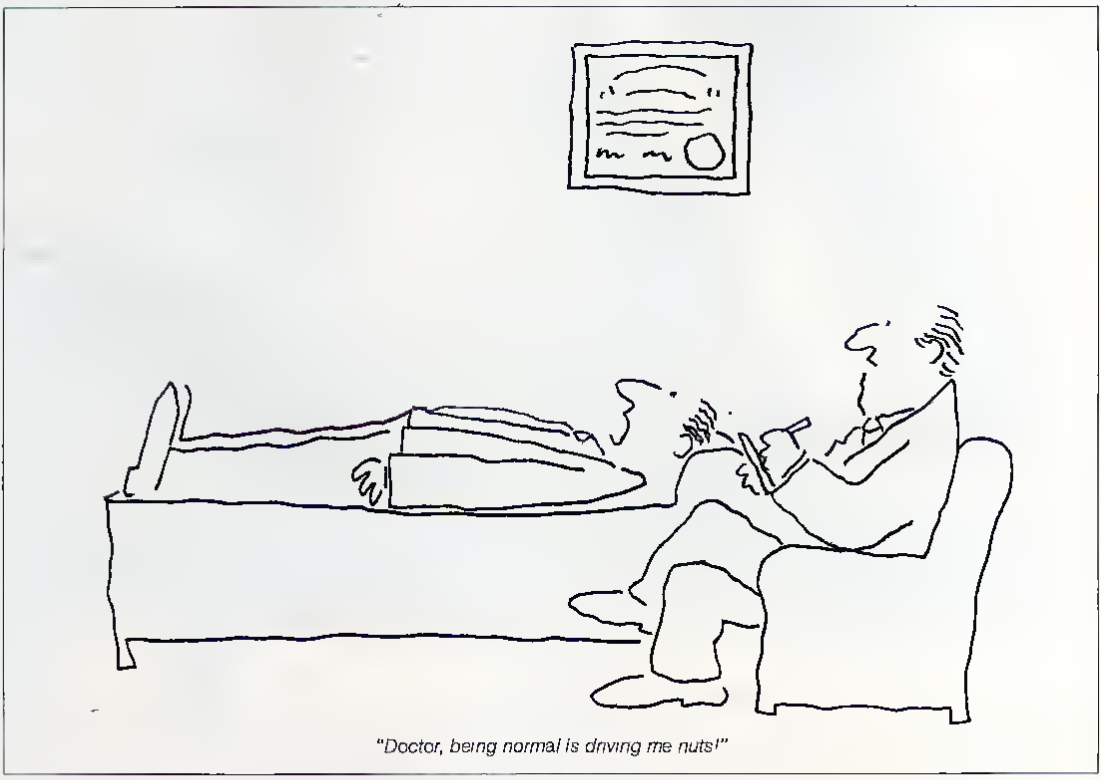
*Data processing has also entered our lives. Tomorrow it will control more and more aspects of our lives. Do you foresee problems in this?*

What's worrying you? Data processing is an instrument, no different from any other. You could ask yourself the same question about railroad timetables.

*I think it may be the prelude to a still more policelike society, with no way out.*

You seem to grant that hierarchical systems of dominance, of whatever kind, will perpetuate themselves. On that subject, I am neither an optimist nor a pessimist. Data processing in the hands of a totalitarian and coercive power can be frightening. But what is at issue is not data processing, which is an instrument and nothing more, but power—all forms of power.

Up to the present, technological evolution has made it possible to maintain and reinforce regimes. But today I conceive that it might lead to a progressive and slow destruction of all power. Success will depend on the capacity to break the present monopoly of information networks. These networks will become so complex and diversified that power will soon be outflanked and will lose the total control of the system. Censorship of thousands of parallel channels of an information network becomes an insoluble problem.



*"Doctor, being normal is driving me nuts!"*

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CHRISTIAN DE DUVE

To be a native of a small country like Belgium has advantages as well as disadvantages. All cultures and all currents of thought cross these Flemish plains—plains buffeted by all intellectual and political winds.

Christian de Duve, one of the most illustrious men of science in the West, is *par excellence* a citizen of two worlds, the New and the Old, since he teaches both at Rockefeller University, in New York, and at his alma mater, the Catholic University of Louvain. The latter is an eminently European and cosmopolitan university, and it is there that De Duve has set up his International Institute of Molecular Pathology.

His work, entirely a matter of patience, attention to minute detail, and hypotheses long considered and verified, at the bench of the laboratory, won him the Nobel Prize in 1974—an award obtained after he had discovered lysosomes and peroxysomes, an important stage in getting to understand the inner workings of the living cells of which these particles are a part. De Duve's contributions in the fields of biophysics and biochemistry make up an exceptional career, and the list of his professional publications is considerable.

He is strict. I can easily imagine him wearing ruffs in Rembrandt's *The Anatomy Lesson*, playing the part of Master Nikolaas Tulp, the professor. But behind his forbidding appearance is a very generous man. He devotes himself to his students and to causes that seem to him just: the cause of scientific researchers lacking funds, and that of disapproved persons—the dissidents of the Soviet Union and other nations. This strict bourgeois of Flanders is a great gentleman.

*To come to the man of the twenty-first century, do you see him as more convivial or more aggressive?*

I would be tempted not to answer that question. I may talk as an expert on biochemistry or cellular biology, but am I really capable of making pronouncements on such problems as the aggressiveness of my contemporaries? I must admit that I'm a bit allergic to the disease that has afflicted many of my colleagues, that is, using the pretext of distinction accorded them for having done some precise scientific work to make pronouncements on the affairs of the world as if they were augurs. To be a good scientist, one doesn't necessarily have to be wise, and one needs even less to be well-balanced. Many researchers I know are totally lacking in good sense and judgment.

But since you asked me, I will answer not so much giving you an opinion as telling you how I feel. I'm going to give you some examples. The generation of my children—that of the students of May 1968—seems in the eyes of my generation to be much more aggressive because it challenges what we in our youth learned to respect above all, authority. The young people have challenged the authority of parents, then that of their professors at the university, of the regime, the police, and so on. They are at war against all forms and manifestations of authority in the world, and sometimes in a violent manner. On the other hand, I believe they are much less aggressive toward one another than we were. I get the impression that young people want to eliminate from their social fabric certain forms of competition and aggressiveness that were considered normal in our society. I believe the aggressiveness remains, but that the target changes from one generation to another.

*What kind of sexuality will we have tomorrow in a world where, from the contraceptive vaccine to the test-tube baby, conception and sexuality will be totally dissociated?*

I'm not a moralist, but that strikes me as an excellent thing. One unique trait of man—what distinguishes him from almost all other animal species—is the permanence of his sexual availability. Human sexuality is not genetically tied to the simple needs of reproduction.

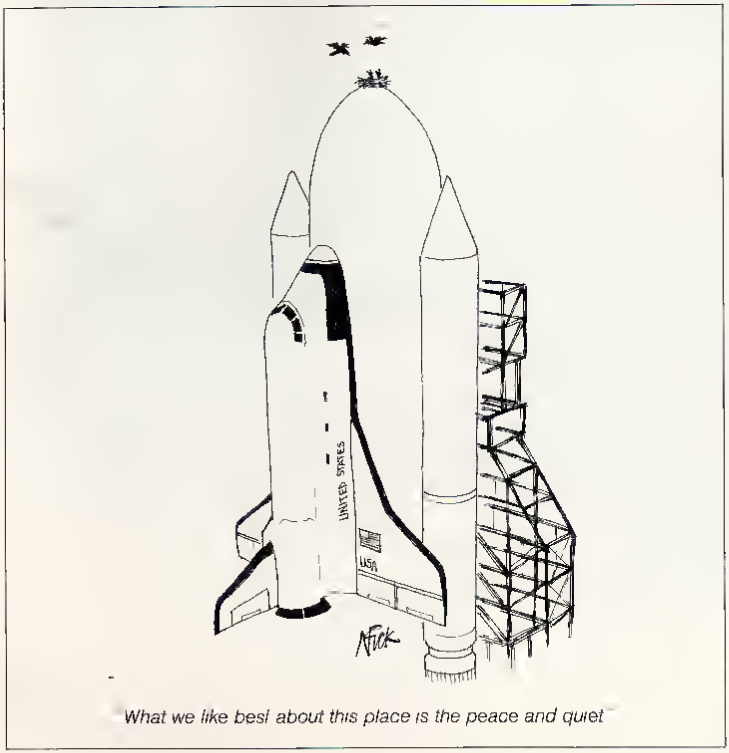
As for the laxity we find in society today, I see it as an episodic phenomenon. I believe there have been periods when people were puritanical and other periods when they were more tolerant. Libertinage has always existed, as has the spirit of the Victorian Era, and they have succeeded each other with variable rhythms. The pendulum movement is frequently found in history.

It would not surprise me if our grandchildren re-created a society that would again become very puritanical by reaction against the excesses of their parents or grandparents.

*People hope for so many miracles from the new biology. Some of them are already talking of that discipline as capable of providing answers not only to our therapeutic problems but to nutritional, industrial, and other needs of tomorrow's world. Do you believe that?*

It is always dangerous to promise miracles. The answer to your question is twofold: No for the miracle, but very strongly yes for the prediction that pure biological knowledge is going to enable us to find solutions to a great many problems. I'm convinced of that. We are for the first time entering an age in which we are beginning to understand the phenomena of life—not only understanding them, but analyzing them with more and more powerful means.

Thirty years ago the living cell was unexplored, a kind of terra incognita, a black box. Today we have opened the box, taken it apart, and understood the structure of DNA. We know how to make a copy of it and introduce it into a bacterium, obliging the latter to make the product coded by the foreign molecule. Witnessing this revolution is something really prodigious. We have acquired so much information about the life processes that progress in the future is bound to be spectacular.




*What we like best about this place is the peace and quiet.*

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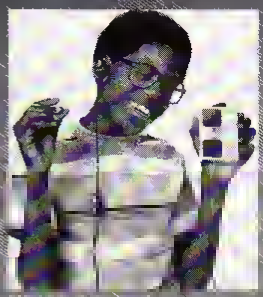


**Panasonic.**

*"Fascination gave way to national hysteria when the fireball kept returning week after week"*

# ANTI MATTER

## UFO UPDATE

Hundreds of thousands of Russians saw a fireball streak over the Volga River toward the twilit mountains in the distance. It was a warm May evening in 1967 and the witnesses—everyone from peasants to airplane pilots—watched entranced as the crescent vanished in the eastern sky. But fascination gave way to national hysteria when the fireball kept returning week after week for more than six months. Then, in October of that year the Soviet government did something totally out of character. After ignoring the UFO phenomenon for decades it set up a semiofficial investigative committee, composed of its most gifted astronomers. A few years later under the auspices of the prestigious Soviet Academy of Sciences the members issued their analysis. UFOs were *real* and unlike anything known to mankind.

But it was all a sham. The Soviet government knew the truth behind the UFOs because its space program was launching them. They were illicit tests of nuclear missiles that orbited the earth then soared back down over the USSR. Soviet military officers were no doubt pleased that the world thought of them as space vehicles from another planet since Moscow had just signed a solemn Outer Space Treaty forbidding the use of exactly those kinds of orbital weapons. Indeed the Soviet Union managed to deceive people at home and abroad for 15 years—until I broke the ruse a few months ago.

The cover-up began unraveling when I traced recent UFO sightings in Russia and South America to secret Soviet missile tests (UFO Update, August 1982). It was clear that the Soviet government had actually encouraged blatant misinterpretation of its military activities in space.

So when American ufologists began extolling a *new* Soviet report on the 1967 sightings this spring, I smelled a rat. Directed by famed Soviet astronomer Lev Gindilis the study analyzed reams of new information and concluded once again that UFOs could well be the chariots of alien beings from space.

Contrary to Soviet plan however this new report helped me prove the UFOs were caused by Soviet warheads. Using report information never before available in the West I compared the times and dates of the sightings with Soviet "scientific" satellites registered at the U.N. In 90 percent of the cases the 1967 UFOs had hurtled through the sky just hours after a "scientific" satellite launch. Research satellites would have stayed in orbit for years of course but it's obvious that the Russians had been launching *missiles* which plummet to the ground after a single revolution around the earth.

By trying to prove that UFOs were real the Soviet scientists were evidently attempting to show that their illegal space tests were *not* real. Computer scientists have a motto: "Garbage in garbage out." The Gindilis report used garbage and produced garbage and the fact that so many Western UFO experts swallowed that garbage so willingly is bound to leave a bad taste in their mouth for years to come. —*JAMES OBERG*

## RADIO FOR THE DEAD

If you've longed to contact the dead, here's some news that should interest you Two-way conversation with the other side' has reportedly taken place via Spiricom Mark IV, a ham radio system used for supernatural communication

"We hit the jackpot on April 16, 1980, says Spiricom inventor George Meek (above), seventy-two an air conditioning expert and president of North Carolina s Metascience Foundation He claims on that date to have contacted the spirit of George J Mueller, a physicist who was employed as a professor at Orange Coast College in Californie, before his death in 1967 'Dr Mueller told us his social security number and intimate details of his life and scholastic activities—which we verified, Meek reports Communication with Mueller suddenly ceased last November however, and Meek speculates that the departed academic ascended to a higher astral plane, beyond Spiricom s range

Spiricom, essentially a radio receiver that works at ultrahigh frequency, is operated by Metascience Foundation technician William O'Neill who says he can see and hear the dead Incoming spirit transmissions Meek explains, travel from the receiver through an audio unit, which produces the robotlike voice of the deceased "The entire Spiricom system including the clairvoyant operator' Meek theorizes "interacts with the space-time sector in which spirits like Dr Mueller live

The Metascience Foundation recently stopped testing Spiricom to focus on the use of plants as mediums for communicating with dead persons But a cassette recording of Dr Mueller s voice and a manual describing Spiricom can be purchased by writing to Metascience Foundation, PO Box 747 Franklin, NC 28734 —Eric Mishara

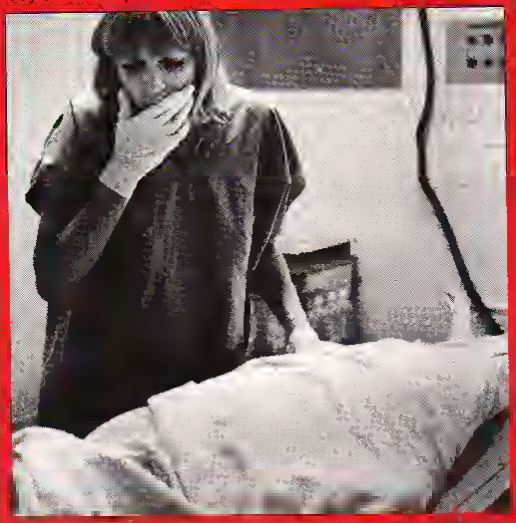
*"We are in the early morning of understanding our place in the universe and our spectacular latent powers"*
*—Marilyn Fergenson*

*"Man is so made that all his true delight arises from the contemplation of mystery, and save by his own frantic and invincible folly mystery is never taken from him, it rises within his soul as a well of joy unending"*
*—Vincent Starret*

## FAMILIAR FACES

With thousands of medical students dissecting thousands of cadavers each year what are the chances of a student's finding the body of someone he or she knows? Better than you might think according to some University of Alabama doctors who reported one such bizarre incident earlier this year

It happened on the first day of anatomy classes,



according to a letter in the *Journal of the American Medical Association*, when a fresh group of medical students faced their first set of cadavers Looking over the bodies one female student was horrified to recognize her deceased great-aunt The body it seemed had been shipped in from the state anatomical board in Florida, where the woman had died Ironically, the student had discussed the merits of body donation with her elderly relative some time before

To their credit, doctors removed the body to another lab in the university and instituted a new policy of checking cadaver names with incoming students "I was proud of the university for the sensitivity it showed," says psychiatrist Clarence McDaniel a cosigner of the letter That student he adds, "quickly recovered from the trauma of the situation "—Lisa Mitchell

*By force of suffering I lost the limits of my body and irresistibly gave up my shape"*
*—Henri Michaux*

## MAYAN ILLUMINATION

Archaeologists have long wondered why the Meyans believed that time began between 4000 BC and 3000 BC Now a new discovery at Copan an ancient site deep within the Honduren jungle might provide us with the answer

The clue comes from a gargoylelike hieroglyph on one of the site s ornately carved columns (pictured at left) The carving wes previously thought to represent the "god of the past, the Mayan equivalent of the beginning of the world But just recently ancient astronomy expert George Michanowsky has reinterpreted the glyph as having a meaning that is far more explicit

Based on specific elements in the glyph—including the symbol for *south* and the symbol for *celestial body*—Michanowsky claims that the sign actually represents the Vela supernova, the most spectaculer astronomical event ever to light up ancient skies The starburst, which is believed to have teken piece about 6 000 years ago created a celestial body the size and brightness of a full moon, and it could have remained visible for up to a year

The reinterpretation, Michanowsky says finelly sheds light on the mysterious "zero date" recurring throughout the Mayan scripts The Meyens began their calendar of recorded time with this miraculous celestial event, he believes, much as the modern Western world numbers years from the birth of Christ

—Phoebe Hoban

*"It is a sign of the ambivalence people feel toward science that scientists are often villains in science fiction"*

*—Isaac Asimov*

## CHOPPER'S GHOST

It all sterted lest year Dentist Kurt Bachseitz, of Neutraubling, West Germany, said he was arranging an appointment with a patient on the phone when a voice blurted out, "You needn t bother going It won't do the slightest good '

The voice, often wisecracking and insolent, was heard time and time again over the coming months The phone company wes called on for assistance end suspecting some kind of electronic interference from a ham radio operator, checked the system thor oughly Then it installed e new line and re-laid all the telephone cable in the dentist's offica building

But nothing worked The voice which took to calling itself Chopper, hed developed a soft spot for the dentist s seventeen-year-old receptionist Claudia "I love you, Claudia it told her Soon it wes projecting from the washbesin, the spittoon and even to the acute embarrassment of one petient, the toilet

Last spring the ghost's voice was pleyed over a Munich redio station for all Bavarie to hear You've taken away my switchboard, Chopper complained ' But I can hear you just as well So don t think I'm not listening In!' The ghost was in all the newspapers now, and all manner of explanations were put forth

A parapsychologist said the voice was definitely a parenormal phenomenon A philosophy professor proposed that the voice wes a ghostly manifestation of the unconscious And doctors suggested it was produced by a cancer patient whose vocal cords had been lost to surgery

Then, in March 1982 Claudia confessed The ghost was the dentist, a skilled ventriloquist It was a practical joke Claudia said that had simply got out of hand

Soon after, the dentist closed his office and entered a sanatorium perheps to escape a possible phone company bill for 60 000 marks —Kendrick Frazier

*"Turn thou, ghost, that way, and let me turn this"*

*—John Donne*

## PSYCHIC M.D.'s

Medical schools may soon carry courses in a subject once laughed off as mere superstition—psychic phenomena.

In a survey of 228 medical-school faculty members, psychiatrist Stanley Dean, of the University of Miami, in Florida, found that doctors are starting to take the supernatural quite seriously. Of the academics questioned, 58 percent favor the study of psychic phenomena in university psychiatric programs, 42 percent believe it's possible that paranormal episodes occur, and 35 percent claim either to have experienced firsthand a psychic event—such as extrasensory perception, telepathy, precognition, or altered states of consciousness—or to know someone who had.

Dean also says that many of the doctors surveyed believe psychic factors are important and see the need for research on healing by nonmedical means. Dean himself hopes to pursue "metapsychiatry," the study of the relationship between medicine and the paranormal.

"My colleagues are gradually coming out of the closet on psychic phenomena," Dean concludes. "More than half the sick people in the world seek out healers rather than doctors, and it's important to know why." —Robert Brody

*"The usual question is, 'What is the use of so many planets as we see about the sun?' To which the answer is, that they are worlds or places of habitation."*

*—William Derham*

## INNOCENT EARS

Merlin Dean Merkland went on trial this past spring for burning down a building in Fairbanks, Alaska. Even though he had confessed twice—once to a policeman and once on an audiotape—the jury found him innocent.

Markland's lawyers believe the verdict was due partly to Josef Princiotta (below), who helped them select jurors with protruding earlobes. "Large-eared individuals are people you can get a handle on, people with feeling," says Princiotta, a former courtroom artist who, since the age of six, has studied the relationship between body parts and personality.

Princiotta's years of observation have convinced him that ears reflect the peculiarities of the heart and soul. "Unlike other parts of the face," he says, "the ear isn't groomed; the only thing that can warp it is an earring. It unfolds like a flower, freely and on its own, shaped by the energy forces that surround it."

Ronald Reagan's ears, for example, are full of creases, indicating a tendency to hide parts of his personality. Actor Clint Eastwood and California Governor Jerry Brown have no earlobes, signaling a chilly indifference to those around them. Johnny Carson's loose-hanging earlobes reflect his wealthy, freewheeling lifestyle. And Princiotta himself has ears open at the top and square-lobed at the bottom, revealing a receptive person who bears responsibility well.

When not consulting on courtroom cases in Alaska, Princiotta is the star of a casino act in Las Vegas. "I can look at the profile of people," he says, "and tell you, with eighty percent accuracy, how they make love."—Lisa Mitchell

*"For me there is all the wonder and mystery I need in the terra incognita of the human heart."*

*—Ray Coryton Hutchinson*

# SPACE

CONTINUED FROM PAGE 20

part of its own fleet. STC would pay all direct launch costs for American and foreign payloads—solid rocket boosters, external tanks, fuel, and other such "expendables"—but NASA would bear such fixed expenses as maintaining the launchpad. Under this scheme STC would pay NASA about $30 million per launch, or half the total cost. Defense Department launches are already handled this way.

The key question here is whether the launch market is big enough to support a fifth shuttle, and on this point Heiss may be the world's reigning expert. In 1970, while working for Mathematica, Inc., a prestigious econometric consulting firm, he gave the Office of Management and Budget its first economic analysis supporting the shuttle project. A year later he calculated that a shuttle program of 60 flights a year would be economical—an extraordinarily ambitious program averaging about one launch a week.

Today the economist has pared that estimate down. He says the shuttle program could break even with only two dozen or so flights a year. Of those, roughly 20 percent would be given over to private American and foreign users, customers for the fifth orbiter. With McDonnell Douglas's announcement, the chances that a commercial market for the shuttle will materialize seem much enhanced.

It has already proved to be an attractive market. Heiss reports that the Prudential Insurance Company has agreed to put up the cash needed to get the fifth orbiter under way, and investment bankers have been lining up to offer more money if it is needed. "Until the issues are resolved with NASA," Heiss explains, "we are not looking for any outside funding."

The plan carries a little extra insurance for Prudential. If extra flights were needed to carry the payloads that STC signed up, the company would pay NASA for room on other orbiters. But if the market turned out to be smaller than estimated and the STC orbiter wound up flying government payloads, NASA would have to pay STC for the space. It may have been with that in mind that a NASA wit penned this limerick:

An econometrician named Heiss
Spoke to NASA in words quite
precise
"I'll give you big bucks
For one of your trucks
Providing that I set the price."

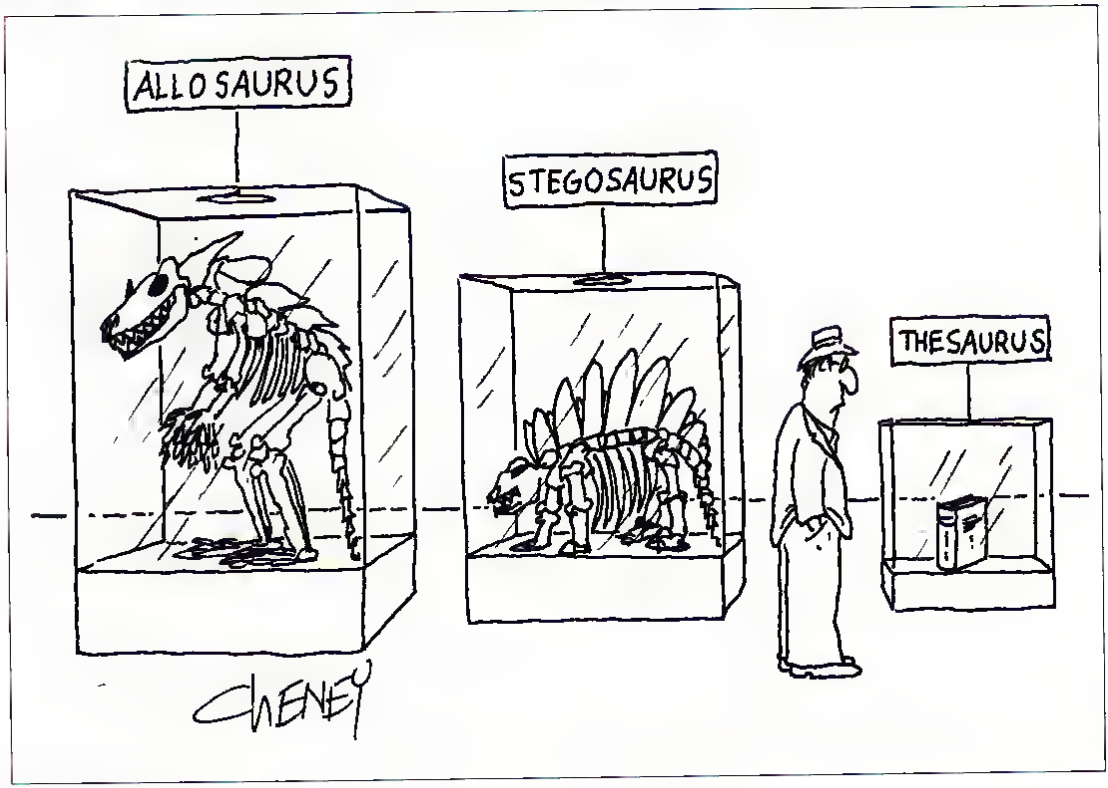
Heiss says he's certain that NASA's policy experts take his plan more seriously than that. "We testified recently before the House Subcommittee on Space Science and Applications," he says, "and it went very well. That was very significant."

Geoffrey Irons is not so sure. Irons is a technical consultant to the subcommittee, and it was he who prepared the groundwork for the hearing. "NASA, the Department of Defense, and Boeing were there as well as STC," he relates. "Boeing told of a study it had performed several years ago that convinced it that it should not try to get into the business of flying the shuttle. Defense said that we need a fifth orbiter and that it should be paid for by NASA."

NASA was represented by Philip Culbertson, who is associate deputy administrator. He agreed that NASA needs a fifth orbiter, if only because of attrition. But he also said that if NASA could get a larger budget from Congress, the agency would not even consider farming a shuttle out to a private firm.

"As far as I can tell, they are studying it now only because there is some interest in the idea here in Congress."

Heiss is unperturbed. "The government does not provide enough money to promote necessary new technologies in space," he observes. "So you have to find a way to channel private capital into space applications, space technology, space transportation. That is what we are trying to do. I can't see how the opportunity for large-scale private investment in space will be foreclosed here by the United States. I think NASA will say yes." Before the year ends, we should know for sure. ∞



# FORECASTS

CONTINUED FROM PAGE 58

found a protein he calls Pc 1 Duarte with especially high frequency in the brains of people who suffer from depressive disorders, schizophrenia, even alcoholism. Like most other possible markers, Pc 1 Duarte presents difficulties because it is also found in persons who otherwise appear perfectly normal. Besides, it is found only in the brain, this means it can be identified only after death, it cannot be used to predict susceptibility in those still living.

The new technology of genetic engineering, however, probably will change this situation. It will become increasingly easier to trace a protein found in body fluids or tissues back to the particular gene that supervises its production and, using restriction enzymes that chop DNA into manageable lengths, to pinpoint the precise portion of the hereditary code that has gone awry. This technique will also make possible identification of genes whose protein products are unknown and of those many genes that do not produce body proteins but rather oversee the actions of the genes that do. (Many diseases may ultimately be traced to malfunctions of these genes.)

The number of people who will eventually be able to gaze into their own genetic crystal ball is potentially enormous. The depressive disorders and schizophrenia are each estimated to afflict between 1 percent and 2 percent of the world's population. So reliable genetic markers for these disorders alone would have an impact on millions of lives. And that may be just the beginning. Elliot Gershon, a psychiatric researcher at the National Institutes of Health, speculates that alcoholism and other forms of drug addiction may likewise be linked to predisposing genetic factors. If we then add to this list such killers as high blood pressure, heart disease, cancer—and sensitivities to the food, pollutants, or toxic chemicals that may lie at their root—just about everyone might be affected.

How will we react to knowledge of our genetic Achilles heel? Will we resign ourselves to inexorable destiny? Or will we attempt to alter our future? If so, what steps will we be prepared to take? Will particular jobs be forbidden some of us? Will abortion for genetic reasons become common? Will we resort to preventive detention for potential drug abusers? Will booze be available only to the nonsusceptible?

Most important, how will we view these new, more planned, more controlled lives of ours? Will we resent having to choose carefully the food we eat and the place we live? Or will we see those choices as enhancing our freedom, offering us, for the first time in human history, ways of avoiding the fate meted out to our helpless unknowing forebears? To answer these questions, we need something that is not on the research horizon: a social, rather than a genetic, crystal ball. ◻◻

## COMMUNICATIONS

CONTINUED FROM PAGE 10

"uncovered" in a dramatic series of raids.

Most of the people caught in these operations had nothing to do with poaching or smuggling but were researchers and breeders who were often entrapped or enticed into violating vague or questionable laws of which they were unaware.

Gary Casper
Milwaukee, Wis.

### Elitist Motto

I thoroughly enjoyed the "Careers in Space" presentation cosponsored by *Omni* and Delta V given as a part of Space Week at the California Museum of Science and Industry, in Los Angeles. However, I was somewhat unsettled by your choice of a motto: "The Meek Will Inherit the Earth. The Rest of Us Will Go to the Stars."

As I understand it, the goal of these presentations is to generate a broad base of grass-roots interest in space. I think that this goal is not served by the elitism implied in that motto.

With the high cost of space research and public doubt as to the worth of this expense, the last thing the grass-roots movement needs is an elitist image.

Howard Neely III
Los Angeles, Calif.

### Biting Back

Your correspondent Robert Noland, in his letter headed "Big Mouths" [Forum, July 1982] reveals quite plainly that he has never been involved in serious fighting. He claims that "No member of the genus *Homo* ever used his teeth as a weapon unless he had some physical disability or had his hands tied."

Deprived of guns, knives, cruise missiles, or napalm, a man (or woman, of course) has a choice of kicking an opponent to death—difficult without shoes or karate skills—punching, gouging, scratching, biting, or strangling.

If Mr. Noland compares the effect of tearing a piece of steak with his fingers to chewing it with his teeth, it should be obvious to him how effective teeth are as a method of attack or defense.

Mr. Noland should accept the fact that Dr. David Marshall is a qualified orthodontist and presumably knows what he is talking about.

Paul J. Hamer
Purley, England

### Icy Expert

*Omni*'s article in Continuum entitled "Mystery Lake" [July 1982] contains an error.

There may be an ice-locked sea somewhere along the coast of Antarctica, but it most assuredly is not "near the South Pole," as Madeleine Lebwohl asserts, unless she is referring to the magnetic South Pole instead of to the geographic pole.

Generally, when one makes a reference to the South Pole, he is referring to the geographic location, which is several hundred miles inland from the coast of the continent, where the 9,000-foot-thick icecap overlies a landmass.

Bruce Gaylord
Amundsen-Scott, Antarctica

### Travel Bug

On the occasion of my reading Mr. Sam Nicholson's Last Word [July 1982], I've taken pen in hand to differ, yes, even dispute, his myopic view and trendy analysis of tourism and its impact.

Mr. Nicholson's account of the unpleasantness sometimes associated with travel draws attention to the fact that he is a world traveler (however reluctantly). He seems to think that his habits are pristine and unlike those of the masses who threaten to ruin his holidays.

If Mr. Nicholson truly believes that Hawaiians do not want tourists, he should provide the islanders with a plan to cope with the poverty that would result from the lack of this influx of visitors. The salt spray has had a negative effect on Mr. Nicholson's sense of what is real and what is imaginary. Visitors bring dollars and jobs to Hawaii. Every state should be so fortunate as to have that kind of healthy travel industry to deal with.

Skip Becker
Harrisburg, Pa.

### Secrets of the Universe

I read with interest, albeit mild confusion, the article about tesseracts and the four-dimensional tic-tac-toe [Games, June 1982]. There is one important thing about successive dimensions that I feel Mr. Scot Morris has overlooked. That is the ability of an object in any given dimension to hold an infinite number of objects of a lower dimension within itself. Consider: A two-dimensional square can hold a limitless number of one-dimensional lines inside it. A three-dimensional cube can hold an infinite number of two-dimensional squares. Therefore, a four-dimensional hypercube should be able to hold an infinite number of three-dimensional objects without having any of the objects overlap.

Now consider an open universe. Physicists say that it would hold infinite amounts of matter. How is this possible? Our universe is a four-dimensional hypersphere! *Voila!* One of the secrets of the universe realized! (Well, maybe I'm overdramatizing, but....)

Michael Cain
Saline, Mich.

### The Eyes Have Had It

I have been reading *Omni* since its inception and have always found it visually very appealing—up until the July 1982 issue. Why is your magazine full of pictures of eyeballs from the cover on through? It made me feel queasy. If I want big ugly eyeballs staring at me, I can look in a mirror.

Michele Jeffries
Palo Alto, Calif. ☐☐

# EARTH

CONTINUED FROM PAGE 16

or walk on the surface or fly in the air Earthquakes could cause changes in magnetic fields, but that would disorient animals rather than make them jumpy

No Tributsch needed something to panic a whole arkload of animals wherever they lived He found it in positive ions

If you've ever stood near a waterfall he explains you've been bombarded by ions—by exhilarating negative ions that render you buoyant and enthused Positive ions he adds, have the opposite effect causing an uncomfortable combination of torpor and irritability

Tributsch contends that rocks under great pressure emit these positive ions spewing a whirlwind of irritating particles during the massive pre-earthquake compression Once released the irksome ions push snakes and rats out of their burrows and provoke dogs to jump and howl Birds jolt through the sky as the ions drift upward Chickens refuse to enter their coops because the ions accumulate in closed spaces Even fish become jumpy (catfish in Japan are notorious for their frenzied behavior) as the positively charged particles create a disturbing electric current underwater Tributsch says

Why aren't humans affected? "It's a consequence of evolution Tributsch believes "We have lost a certain capacity to feel and monitor physiochemical signals although a few people *do* somehow sense that an earthquake is about to come

At first Tributsch's theory met with considerable scorn And because devastating earthquakes are rare it was nearly impossible to test But laboratory geologists at the University of Arizona later found that just as Tributsch said moist rocks under pressure do emit positive ions And the success of the China predictions—published only recently in the United States—indicates that animal premonitions are sometimes right on target

Tributsch's idea has been boosted by a new understanding of other odd phenomena as well The eerie glow that sometimes accompanies earthquakes, for instance and frequent reports of pre-earthquake fog have both been explained by positively charged ions

The glow in the air Tributsch says results from static electricity created when ions are produced The fog appears when ions cling to millions of tiny aerosol particles ever-present in the air

In the past few months a number of scientists have come to accept Tributsch's theory But most doubt the dependability of animals preferring to take their cues from seismic readings instead That's fine with Tributsch, who feels that getting scientists to reconsider an old wives tale is an achievement in itself "We must be humble enough to study the anomalies," he says even if they seem unreasonable DC

# ARCHITECTURE

CONTINUED FROM PAGE 36

strictly visual or formal possibility'

Abraham proposed an architecture composed of machines rather than a design that simply mirrored the functional nature of machines—especially such things as missile sites and other gigantic engineering installations. The designs included "Moon Crater City," to be built beneath the surface of the moon, with craters used as missile launchpads. Back here on Earth 'Radar Cities' was to have enormous radar antennas projecting out of bases embedded deep in several large hills—a whole city for radar dishes. In drawing up 'Universal City' he says, "I was interested in trying to use the whole earth—the globe, the sphere—as a site. So this 'Universal City' would span across the equator like a ring." One of the illustrations for 'Universal City' showed a helmeted astronaut looking out of his craft at something that resembled a ring of immense supertankers encircling the earth. "You could speculate that the earth's population would be concentrated in that ring," he says, "while the rest of the globe somehow would return to nature. It would form a radical distinction between the technological or intellectual domain of man and the natural."

„Like something that a higher intelligence might have constructed from a child's Erector set, these whimsical cities confounded the then-reigning standards of socially oriented architecture. But could they be built? 'Anything that can be formulated is real,' Abraham responds. 'What can be built? Today anything can be built, or if not today, in one hundred or five hundred years. I am convinced that technology is reaching that point. It *will be*. So it was of no concern to me whether the cities could be built then.'

From 1967 to 1969 Abraham left fantastic-scale cities and experimented with what he called Synchronized Architecture, an architecture first stripped bare and then filled to the brim. 'I moved from the more or less abstract compositions of my cities to the very concrete formulation of a microworld or microspace. It was an attempt to reduce architecture to the absolute minimum.' Synchronized Architecture was formed of 'Hyperspaces,' an exhibit at the Architectural League in New York.

'Hyperspaces' consisted of a progression of three small rooms. The first two were painted a fluorescent ultraviolet so that the details of the room—corners, wall joints, and so forth—were lost in a luminous glow. Entering the first room, visitors encountered a number of antennas that seemed to float in the glow. These antennas were light- and heat-sensitive. They caused one of nine randomly placed loudspeakers to emit various sounds whenever anyone approached them.

In most architecture we observe the space and the mood that the architect has predetermined. In 'Hyperspaces' the visitor actually participates in the architecture by interacting with the antennas, creating a 'gravity-less' atmosphere of sound, light, and touch. The third room in the series was a pure white cube that served as a dramatic counterpoint to the first two. 'I was obsessed with contemporary technology, invisible light beams and light-sensitive cells. This was around the time of our first astronauts in space, and I was interested in showing that these new tools of technology could help us reach out to the opposite of the gravitational path.'

'Zero-Zones,' its companion piece, was an attempt to reinforce gravity. In it Abraham "filled" a triangular room—like turning a pyramid on its side and putting a ceiling and walls around it—then cut paths through this pyramid. "I cut passages about eighteen inches wide," he recalls. "They were all parallel, so that when you walked through the last and tallest one, no one could observe you, because you were totally enclosed by the walls. Each cut created a passage, and each passage became shorter and shorter, moving down toward the pointed end. Your selection of which passage to walk through determined the visual impact your body would have on the architecture of the room."

Drawing on the knowledge gained from experimenting in the megaworld of Cities and the microworld of Synchronized Architecture, Abraham went on to develop a number of single Ideal Houses. With names like "House Without Rooms," "Earth-Cloud House," "House with Curtains," and "House with Permanent Shadow," they make up what critic Kenneth Frampton calls a "hallucinatory landscape." "House Without Rooms" is three narrowly spaced walls with globular forms that are suspended between all three. These "globes" provide areas for eating, sleeping, ironing, and so on. The "Earth-Cloud House" seems to trap a cloud between a cavernous hole in the ground and a glass "pit" that seals the opening. The "House with Permanent Shadow" features a tall, wide wall that extends half-aboveground and half-belowground. Its "shadow" is composed of glass panels that form the roof of the house under it.

"House with Curtains" is evenly split, half-above and half-below the ground, divided by the line of the horizon. Below there is a tunnellike entrance, and there are several rooms. Above is a gridwork glass cube, unbroken by any doors or walls. One enters the enclosure by a stairway from belowground. Whole house-size curtains are hung along each of the four walls—outside the cube—almost like some Space Age Kaaba. "I was trying to monumentalize single events," Abraham says of these houses. "The curtain, for example, is a known component, a very ordinary element with a memory of use, decoration, and symbolic meaning that stretches back through history. By using the curtain on the

outside instead of on the inside you introduce a certain surreal dimension to this very simple and traditional act."

One of his most recent projects best illustrates Abraham's further realization of his earlier visions.

Berlin's Kongresshalle was constructed in 1957 from a plan by American architect Hugh Stubbins. A unique symbol of Western freedom and democracy in the former German capital, it collapsed on May 21, 1980. Abraham proposed a kind of "living tomb" for the remains, to be called "Monument for a Fallen Building." The original structure had been controversial from the start. It was intended that the hall "float" underneath a prestressed concrete shell. Conservative German structural engineers at the time rejected the first plan and forced the establishment of a connection between the floor of the hall and the wedge of the roof. The connection placed too much pressure on the roof and contributed to its collapse. Abraham's monumentalization of the collapse is now just as controversial as the bygone Kongresshalle. It consists of a massive cube split in four that would entomb what still stands of the Kongresshalle's roof (sections of it would jut out from the cube's walls), and a new hall would be built inside the cube). The memory preserved here is one that the responsible officials would undoubtedly like to forget, so it's improbable that the city will ever fund Abraham's daring plan.

In Berlin particularly Abraham has found the perfect expression of historical memory, symbolism, and his own architectural vision. Immediately adjacent to the Berlin Wall, Abraham has planned a church that will rise as a broken element of the divided city. This "Berlin Church"—a cruciform structure—will rise some four to five times the height of the Berlin Wall. Its dynamic form will be seen unobstructed for miles in the eastern sector. In the late afternoon light a cross-shaped shadow cast by the church will fall directly on a munitions dump located on the Communist side of the wall. Abraham terms the church "a philosophical reaction to the architectural phenomenon of the wall...a bridge between East and West that is obstructed by the intervention of the wall." As is not so of the Kongresshalle plan, the "Berlin Church" is rapidly gaining the financial and political support necessary for its realization.

Abraham feels strongly that the future of architecture rests in fragments. "I believe that there will never again be anything like a coherent style because there will never again be a coherent society that can be politically, economically or culturally confined to particulars. The only real chance for a new architecture in the cities or anywhere else lies in clarifying the individual manifestation—the single house or the single fragment. There can be an infinite number of independent single fragments occurring at the same time that can lead to a totally new iconography, but it is completely unpredictable." DQ

*Etymology the study of things that are hard to swallow*

# COMPETITION

By Scot Morris

Does *S O S* stand for "Save Our Ship"? Was the butterfly originally called a flutterby? Did *posh* come from "P O S H" (Port Outward Starboard Home), the initials stamped on steamer tickets of wealthy English tourists traveling to India, guaranteeing berths on the shadier side of the ship?

You can find these stories in many books about word origins and hear them repeated at cocktail parties. The stories are believable, inventive, and interesting. They make great conversation pieces causing comments such as, "Gee, I didn't know that. Does it really matter that they aren't true?

Our Competition #23, announced last February, asked readers to "sabotage the science of etymology by creating a new derivation." We wanted word origins that were just plausible enough to fool people at cocktail parties. In twenty years, we said, "we want to hear someone tell your derivation and swear it's true because he 'read it somewhere.'"

Readers concocted a host of new origins" (a word one said, that derives from *Orion* and *gin*, hence, a theory propounded after taking a "belt" of juniper juice). We favored entries based on real root forms that were just credible enough to make us wonder. We also picked some absurd inventions (after our example of *seminars*, which is from *semi* and *arse*; hence, any half-assed discussion).

We saw multiple explanations of certain obscenities and of such provocative terms as *hooker*, *cocktail*, and *O.K.* The expression that elicited the widest variety of theories was *mind your p's and q's*. It's from the practice of innkeepers who tallied the pints and quarts of ale drunk on credit by their customers (Sally A. Knab, La Honda, Calif.). For children learning to write, it was a reminder to avoid confusing these two lowercase letters (W. Blue, Frankfort, Mich.). It's a shortened form of "mind your pleases and thank-yous," an admonition to a child to be polite (Bob Meadows, Marion, Ohio). In the days when schools taught proverbs and quotations to guide a child's moral development, this warning was an equivalent of "Mind your manners" (Richard Boyce, Menlo Park, Calif.). From the syllogisms used in symbolic logic—which frequently use the two letters as in "If p, then q"—the phrase means simply "Be logical" or "Pay attention to detail" (Gary Melikian, San Diego).

In order to maintain the proper level of confusion, we have included in the list below at least one derivation that is considered by etymologists to be correct. That's so you can drop any of these tales into your conversation and say, "I'm not sure whether this story is true or not, but . . ."

## GRAND PRIZE WINNER $100

POLITICIAN. From the Greek *poly* ("many") and the French *tête* ("head" or "face," as in *tête-à-tête*, head to head or face to face). Hence, *polytetien*, a person of two or more faces.

*—Martin J. Pitt, Birmingham, England*

## RUNNERS-UP $25

CALIFORNIA. From Latin *calor*, meaning "heat" (as in English *calorie* or Spanish *caliente*), and *fornia*, for "sexual intercourse" or "fornication." Hence, Tierra de California, "the land of hot sex."

*—Ed Moran, Covina, Calif.*

BACKGAMMON. From the days when checkerboards were printed with another game played on long triangular spaces on the back side. Backgammon was "the back game."

*—Shawn Gimler, Johnstown, Pa.*

NELSON. The wrestling holds called *full nelson* (a two-arm hold) and *half nelson* (a one-arm hold) are derived from Admiral Horatio Nelson, who lost his right arm in 1797 at the battle of Santa Cruz de Tenerife in the Spanish Canary Islands.

*—L. M. Chare, Chester, England*

NYLON. The amazing polymer was so named because it was simultaneously discovered in the Du Pont labs in New York and London.

*—Don G. Pierson, Bowling Green, Ky.*

MIRAGE. A contraction of the words *mirror image*, taken from a theory of how these desert illusions are created.

*—P. J. Veber, Mount Pleasant, S.C.*

WILLIES. This word was derived from a description of William Tell's son before the apple was shot off his head. It has come to mean a state of extreme nervousness and anxiety.

*—C. Duran, Pueblo, Colo.*

CONDOM. Originally from the Latin *Contra Dominum*, which means against, or contrary to, the will of God.

*—Kenneth Newton, Ridgecrest, Calif.*

FLEAS AND TICKS. The names originally described how these two types of parasites behave when a dog's coat is brushed—the first kind flees, the second kind sticks.

*—L. A. Dillard, Temple, Tex.*

ETYMOLOGY. Some early etymological scholars came up with derivations that were hard for the public to believe. The term *etymology* was formed from Latin *etus* ("eaten") the root *mal* ("bad") and *logy* ("study of"). It meant "the study of things that are hard to swallow."

*—Mike Kellen, Oakdale, Minn.*

## HONORABLE MENTION

STRIDENT. From the same root as *Streisand*.

*—Peter Moir, Fotheringham, Dunblane, Scotland*

METEOR. Originally a newspaperman's coinage from *metal ore*, which described the composition of these stones from the sky.

*—Sheri Blystone, North East, Pa.*

CRESTFALLEN. Attributed to a feeling of despair after toothpaste sales reached an all-time low. (See AIMLESS.)

*—Alan Levine, Massapequa, N.Y.*

VALENTINE'S DAY. The English of the Middle Ages observed the first faint signs of spring with a fortnight of

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# EXPLORATIONS

By Odean Cusack

By midnight, when Robert Schoelkopf, director of the Marine Mammal Stranding Center arrived on the Wildwood, New Jersey, beach, the 600-pound pilot whale was dazed and exhausted. Well-meaning spectators had tied a rope to its tail and attempted to drag it back out into the surf, but the animal thrashed violently and struggled to stay on the sand. For this whale, its life ebbing, the beach was a final, and fatal, port.

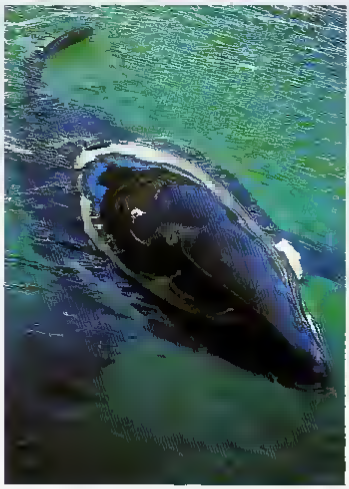
Using a special stretcher that he designed to transport cetaceans, Schoelkopf, an ex-medical corpsman in Vietnam, hoisted the ailing mammal onto an old pick-up truck and sped back to his Atlantic City facility to begin emergency treatment. He placed the whale in a tidal pool in sheltered Gardner's Basin, where he could remain with it until the crisis passed. Marine mammals can survive for only a few minutes without surfacing to breathe, and a sick whale, unable to maintain its balance, can easily flip over and drown if left unattended.

Schoelkopf talked to his ward, and the whale responded with a clicking vocalization usually reserved for communicating with its own kind underwater. He coaxed it to eat, and once the animal mistook his hand for a fish. Pilots are a toothed species and can inflict injury. But the outcome of this contact was a poignant bond between doctor and patient.

A favorite seaside tourist attraction, salty Gardner's Basin still retains the appealing air of the days when ships were tall and whales were plentiful. Now the historic locale had the added distinction of harboring an ambassador from Neptune himself. In the days to come, visitors, enthralled by the city's newest celebrity, watched in awe as the ten-foot-long black titan swam slowly around the pool, gently nuzzling the coaxing hand of its benefactor.

Every year some 2,000 assorted sea mammals beach themselves on the eastern seaboard alone. Of these strandings, perhaps 10 percent (though the figure may be much higher) are still alive when discovered. However, they are rarely saved from death. Aquariums that attempt such rehabilitation consider one out of a hundred kept alive a commendable record. Nevertheless, since 1976, when Schoelkopf founded the Marine Mammal Stranding Center, his organization has successfully treated and returned to the ocean numerous seals and sea turtles and, unprecedented for that species, a harbor porpoise. When health is restored to the ailing animals, it is less a miracle of modern medicine and technology than a tribute to a practice as ancient as the art of healing. The secret of Schoelkopf's success is round-the-clock tender, loving care.

"Part of the medication for a human patient in a hospital," Schoelkopf says, "is the care and attention shown by the doctors and nurses. This, in itself, improves their well-being. The same holds true for marine mammals. They are gregarious animals with a highly evolved intelligence. They recognize you. They want attachment. They need this attention. When they can't get it from their own kind, they'll seek it from the next best thing—human beings."



*Help for whales and other marine mammals*

Doctoring the seas' denizens seems an unlikely profession, but not for Robert Schoelkopf, whose yearbook ambition was "game protector." While working as a dolphin trainer at a now-defunct seaside amusement park in Atlantic City, he campaigned for the rights of performing animals. It was during this disenchanting phase of his career that Schoelkopf came upon his first stranding, a rare pygmy sperm whale, which he managed to keep alive for four days—an encouraging performance, at least. Shortly after that, he started the Stranding Center with his longtime associate, Sheila Dean, and a small band of dedicated volunteers.

From his own experiences, Schoelkopf has no illusions about commercial marine mammal shows. "No matter how educational the shows are," he says, "the dolphins and porpoises are put in the tank so somebody can make a buck. And when you're worried about making money, you don't care about the animals."

Worse, few of the mammals featured at aquatic attractions are raised in captivity. Most are bagged wild, a traumatic and often fatal experience. For every two marine mammals that survive to delight audiences, ten others may die in the process. Although a sick or injured animal that has little or no chance for ocean survival could ethically be kept in captivity, the effort is seldom made. Euthanasia is quick, easy, inexpensive, and, in Schoelkopf's opinion, a cop-out. "Experts" advised him to dispatch the pilot whale. Instead, he nursed it back to health. Its recovery imminent, he consented to transport the hefty leviathan to Mystic Aquarium, in Connecticut, until the money needed to effect its release could be obtained.

Returning the sociable mammal to the ocean would have been a banner achievement in the annals of marine science, but fate, in the form of governmental bureaucracy, intervened to block the triumph. Rehabilitation was successful, but the patient died, suddenly

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dealing with large numbers of people who for the most part have never tried such an experiment and who are participating without the presence support, and moral guidance of a researcher

We hoped to overcome the hurdles of the abstractness of the target and also of putting untried subjects in a situation in which they had to work at an unfamiliar task without other human interaction To what degree we succeeded is not clear, since the experiment did not reach 20-to-1 odds But the fact that the results were greater than chance suggests that we are at least proceeding in the right direction

The results also helped us draw some interesting conclusions about *Omni* s readers We paid particular attention to the gender of our test takers One of the results of an earlier test with 25 000 students was that there was a significant difference in the ratio of men to women who manifested psychic abilities There were 8 747 men who participated in the Psi-Q I test Of these 417 got four of the five targets correct And of the 6 723 women who participated 326 were four- or five-target hitters This computed to 4 8 percent for each sex No discernible difference

What did surprise us was the number of women who responded According to *Omni*'s demographic studies approximately three out of four readers are men yet fully 41 percent of the test participants were women Clearly female readers are very interested in psychic research

Other variables such as a participant s age his being right- or left-handed, and his job category were not significant in distinguishing between those who managed to predict the correct clock position and those who did not

Another thing that surprised us was the way our respondents perceived time Some people picture it as a dynamic moving force, others see it neutrally, or as a passive phenomenon. In earlier smaller studies, those who viewed time as dynamic tended to do best in precognitive tasks In the Psi-Q I test, though there were too few successful predictors for us to make any firm connection between psi and time perception, it seems that "time neutral" participants did the best of all.

This may reveal a flaw in many small studies of psychic ability. Experiments in the social sciences often rely on a single narrow source for test subjects: college students majoring in the area under study It now seems that using students as subjects may produce biased results not relevant to more general populations

One of the test s most important sections was designed to disclose any connection between paranormal ability and the halt of the brain that people tend to use Popular theory holds that the right and the left hemispheres of the brain specialize in

different kinds of thought. The right hemisphere is associated with creative, spatial, analogical, emotional, and aesthetic concepts; the left is associated with verbal, analytic, and temporal concerns.

Many of us use one side of our brain much more than the other. Some of us consistently respond to our circumstances with right-brain styles of thinking; others with left-brain responses. Still, some people act in accord with whichever hemisphere is more appropriate at a given moment. And still others are 'undifferentiated'; their responses shift, apparently at random.

Studies by parapsychologists, psychologists, and social scientists have suggested that both psychic powers and intuition spring from the right hemisphere. Most important, there seems to be a strong connection between the right hemisphere and creativity. Therefore, if a connection could be found between psi and the right hemisphere, it would suggest a similar link between psi and creativity. A number of studies of psychic experience have hinted at just such a bond.

In preparing the Psi-Q I challenge, we adapted a creativity test that ideally suited our needs. It was originally designed by Professor E. Paul Torrance, of the University of Georgia, and was particularly interesting to us because Torrance thinks his test establishes a connection between creativity and the hemisphere of the brain we use.

Of the 15,470 people who completed the Psi-Q I exam, 4,551 proved to be right-brain-dominant and 985 depended on the left brain. This marked difference probably is not true of people in general, but it does make an interesting comment about those *Omni* readers who took this test.

Science-oriented people, most of us think, are very linear-minded and analytical. According to this test, that's simply not so. Instead, a strong interest in science seems to go hand in hand with a strong imagination and the ability to see the world as a whole, not just as a jumble of unrelated pieces. The real attraction of science has as much to do with a sense of wonder as with the step-by-step processes by which scientists turn that sense of wonder into knowledge.

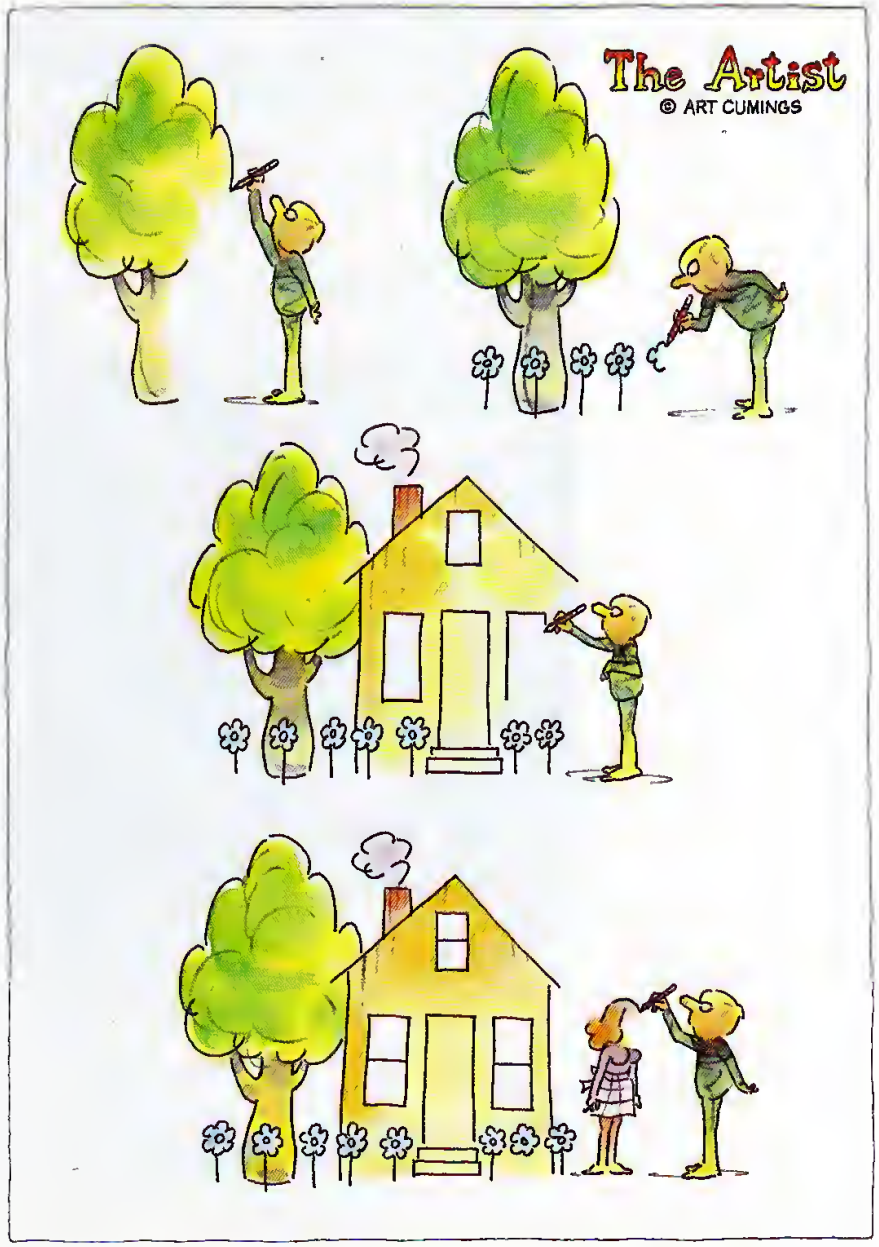
Our data also supported the idea that the right hemisphere is involved with creativity. The highest number of right-brain people were found in the job category of 'Artistic occupations: the manipulation of physical, verbal, or human materials to create art forms or products. Examples: journalist, musician, graphic designer.' The category that included psychologists, homemakers, and athletic coaches also had a significant number of right-brain types. By contrast, the most sizable number of left-brain thinkers were found in the category 'Investigation of physical, biological, and cultural phenomena in order to understand and control them. Examples: physician, computer operator, engineer.'

The remaining group, the undifferentiated thinkers (there were 6,088 of these among our respondents), formed the largest single group in the entire test population. It might have been much larger. In some studies the 'undifferentiated' category has amounted to as much as 52 percent. The relatively small group (39 per cent) in the Psi-Q I test indicates that most *Omni* test takers have evolved consistent patterns of response to life situations.

We cannot draw any overall conclusions about psi phenomena or what causes them; there simply were not enough correct responses for that. But the test was never really meant as a final answer to the many questions about precognition and related abilities. It was at best a tentative step in trying to understand and develop what may be a neglected natural resource.

According to a recent Gallup poll, around half the people in the United States have had at least one experience they consider to be psychic. That's more than 115 million people. Yet government expenditures for research in this area are dismally small, and industry's contributions are virtually nonexistent. It seems that Americans have something important to say that is not being heard by the establishment.

And it is important. C. P. Snow described nuclear physics as 'the major intellectual achievement of the century.' Listen, then, to Leonid L. Vasiliev, a corresponding member of the Soviet Academy of Medicine, chairman of physiology at the University of Leningrad, and winner of the Lenin Peace Prize. 'The discovery of the energy underlying extrasensory perception,' he declared, 'will be the equivalent of the discovery of atomic energy.' ☐☐


The Artist
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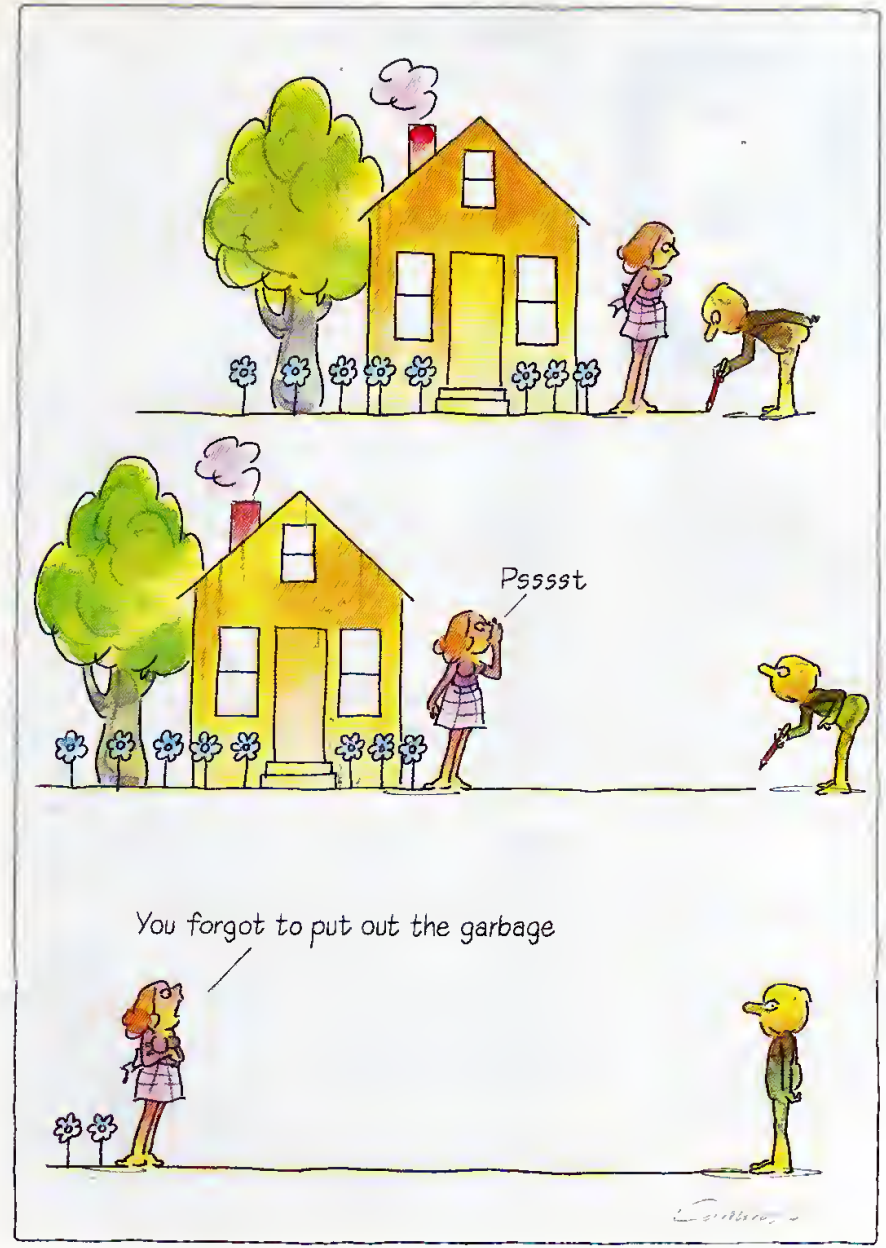
Pssssst
You forgot to put out the garbage

# GAMES

ANSWERS TO GAMES (PAGE 184)

1. WILLIAM JAMES'S SQUIRREL. The confusion James pointed out in his classic philosophic work *Pragmatism* arises because of the imprecise meaning of the word *around*. The paradox dissolves as soon as the word is clearly defined. If by *around* we mean "First to the south of, then to the west of, then to north of, then to east of . . ." then the man does go around the squirrel. It *around* means "First in front of, then to the left of, then in back of, then to the right of . . ." then, of course, he doesn't.

2. CARD TRICK. Take the bet. You'll win every time and walk away with a certain $26! The seeming miracle is based on a secret that magicians call the Gilbreath principle after Norman Gilbreath, a mathematician and amateur magician who discovered it in 1958. Since then hundreds of card tricks have been based on it.

Remember that the bottom card of each half-deck is different. After the first card falls from your thumb to the table, the next card, on *either* side, is of the opposite color. It makes no difference, therefore, which of these cards falls next. In either case, the first pair of cards on the table do not match. The situation is then exactly as before. The next pair of cards will also be nonmatching, and so on for all the rest of the cards in the deck.

The principle can be generalized to produce another neat trick. Gardner explains: "Arrange the deck in a sequence of suits such as SHCD, SHCD, SHCD, and so on. Deal from the top to form a pile of about 26 cards (the exact number does not matter). This dealing automatically reverses the order of the cards. Now riffle-shuffle the two halves together. Take the cards from the top in quadruplets. Each set of four will contain one card of each suit!"

3. THE UNEXPECTED TEST. Logicians so far have been unable to agree on what is wrong with the student's reasoning. Most people accept the first step, namely that the test can't be on Friday. But even this presents problems. Suppose there has been no test by Thursday, can the students deduce that there can be no test on Friday? No, because if they do, they might come to class and get an unexpected test! The consensus among logicians is that, though the professor knows he can keep his word, there is no way the students can know it. Therefore, there is no way they can make an airtight deduction about the impossibility of a test on any day, including the last one.

4. THE RUBBER ROPE. Your intuition tells you that the journey will never end, but it does! The key to this paradox is realizing that the rope stretches uniformly, like a rubber band, and that the worm is carried forward with the stretching.

A good way to solve the puzzle, Gardner says, is to measure the worm's progress after each second as a fraction of the rope's length after that second. When the sum of these fractions is 1, the worm has come to the end of the rope.

There are 100 centimeters in a meter, so that at the end of the first second the worm has traveled one one-hundredth of the rope's length. After the next second the worm crawls forward another centimeter. This distance covers an additional one two-hundredths of the rope's new length of two meters. After the third second the worm has gone an additional one three-hundredths of three meters, and so on. After $k$ seconds the worm's progress, expressed as a fraction of the entire rope, is

$$1/100\,(1/1 + 1/2 + 1/3 + 1/4 + \ldots + 1/k)$$

The progression inside the parentheses is known as the harmonic series, and its sum can be made as large as one desires. It does not have an upper limit (whereas the geometric series $[1/1 + 1/2 + 1/4 + 1/8 \ldots]$ does, its limit being 2). When the terms inside the parentheses reach a total of 100, the worm will have completed its journey. This will be between $2^{143}$ and $2^{144}$ seconds, which works out to about 5 000 000 000,000 000 000 000 000 000 000 centuries.

5. NEWCOMB'S PARADOX. This bewildering paradox first propounded by physicist William Newcomb, has never been resolved. Logicians are still debating it. Either argument can appear valid, depending on your point of view. "The paradox," Gardner says, "is a sort of litmus paper test of whether a person does or does not believe in free will. Reactions to the paradox are almost equally divided between believers in free will, who favor taking both boxes, and believers in determinism, who favor taking only box B. Others argue that the conditions demanded by the paradox are contradictory regardless of whether the future is or is not completely determined."

For a discussion of the conflicting views see Gardner's Mathematical Games columns in *Scientific American*, July 1973 and March 1974. ∞


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The science fiction movie quiz that appeared in the October 1982 Games column was adapted from *505 Questions About Movies That Your Friends Can't Answer*. The book will be published in January 1983 by Walker and Company.

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are saved each time a cartoon is produced. An even greater saving is accomplished by using the same set of cels whenever the character walks in a particular direction: shooting the same cycle of cels—the series of eight or nine leg positions in a single stride—over and over again as the character continues to walk.

Cost consciousness is on everyone's mind at Hanna-Barbera, and it may be one of the most compelling reasons why the computer might become fully integrated into the operation. Levoy estimates that a Walt Disney cartoon such as *Pinocchio* or *Snow White*, which was made in the 1930s for $2.6 million, would cost around $15 million to produce now if the same level of animation were used. In those two masterpieces every frame of every character was drawn individually, with backgrounds sometimes consisting of as many as five separate planes, each moving separately to give an astonishing simulation of depth. Network television, the main purchaser of cartoon animation today will not spend the money to support this kind of animation, and Levoy and the others in the computer-graphics project know it.

Sitting down to demonstrate the computer's capabilities, Levoy first enters the animation artist's outline drawings of the character's actions into the computer. "At this point," he explains, "the drawings are part of the computer's database—like any other set of shapes stored in a grid coordinate pattern."

As if they had been created digitally in the first place, the drawings can be manipulated and changed. And most important, they can be electronically colored by using digital "paint" programs that allow the artist to treat them as shapes in an electronic coloring book. In the conventional animation process, this is one of the most laborious tasks, requiring an artist to hand-color every element of every cel. In H-B's electronic process, however, the artist uses a penlike electronic stylus to pick a color from an electronic array presented on a TV monitor. He then simply touches the stylus within the area he wants colored, and the computer does the rest, filling the area with the selected shade until the boundary lines are reached. To choose another color, the artist simply returns to the color display and touches the stylus to another of its "paintpots."

"It's exactly like real painting," Odgers observes, "except that there are no drips or smears or differences in paint intensity from one cel to the next. And you don't have to clean your brush."

Underlying this apparent simplicity—and completely invisible to the artist—is a special type of computer memory known as a framestore or frame buffer. The picture area on the artist's TV display monitor reflects the organization of the framestore into at least 262,144 individual memory locations called pixels (picture elements). Each pixel can be displayed in any of the millions of colors of which an electronic color scheme is capable (infinitely variable degrees of red, yellow and blue). The artist, using the electronic stylus, can touch any set of pixels, turning it any color he wants.

The next piece of computer magic Levoy performs is the electronic reassembly of the character's various body parts. Again replacing one of conventional animation's most tedious tasks—the physical photography of the animation cels after first sandwiching the appropriate pieces together on an animation stand—the program is based on some highly complex software written by Wallace, the rival of any work being done today in other advanced computer-graphics operations.

Using the electronic equivalent of a conventional animation positioning grid, the animator assigns each of the body pieces a coordinate in the frame, together with a set of instructions that tell each piece how it fits together with the other pieces. The eyes are defined as completely opaque, for instance, and fit inside the shape defined as "head." The computer now takes the digital information representing the various elements and merges the pieces, performing special operations along the boundaries where two shapes meet so that the "seam" is completely invisible. The electronic operation takes but a fraction of a second.

In a final, almost instantaneous step the character is merged with background art that has also been scanned into the computer using the same kinds of computer programs. Again the computer treats the complex background image as it does any other part of its database: the strings of digital information representing the pixels could as easily be data representing checkbook balances being combined with various income statements.

The completed frame with character and background is then put on videotape. Next, in accordance with a preprogrammed sequence of instructions entered in its memory, the computer slightly changes the background, selects another computer-colored cel, and sends another frame to the video recorder. And the figure becomes animated.

To show the versatility of the system, Levoy asks the computer to generate a cartoon from pieces already in its memory. A little later the playback tape shows Fred Flintstone and Sylvester the Cat being pursued through the interior of a building by a whole flock of Tweety Birds, the image betraying no sign that it was created wholly within the computer's database.

"It seems farfetched right now," Levoy concludes, "but we think the day is going to come when Hanna-Barbera's shelves will be lined not with film cans and stacks of cels, but with computer disk packs and videotape instead."

Levoy, Odgers and Wallace are not alone

in their thinking that computer-created animation might revolutionize cartooning for television. Nor in fact is the H-B experiment the ultimate to which computer animation might be pushed. Even more highly advanced work is being done at the New York Institute of Technology, where programs were originally written by Alvy Ray Smith and Ed Catmull. The two have since moved on to head a special research group at George Lucas's Lucasfilm facility to see how computer-created effects might one day be integrated into Lucas films such as future Star Wars episodes.

Smith and Catmull's work involved two fundamental animation techniques not tackled at Hanna-Barbera: electronic in-betweening and electronic background painting. The latter is somewhat similar to H-B's cel-coloring programs, except that it offers the artist a much wider range of creative choices. The stylus can be transformed into an electronic brush of virtually any thickness, or into an electronic pencil, crayon, or even airbrush. Pieces of the electronic image can be "cut out" and moved around, rotated, compressed, repeated, or enlarged—by touching the stylus to a "menu" of graphics functions displayed alongside the image.

This type of digital art system, originally conceived as a means of electronically painting background images for cartoons in the same way that the characters themselves were created, has found its way into commercial television. CBS is among those that regularly use a digital art system for the preparation of graphics for nightly newscasts.

Electronic in-betweening makes use of another of the computer's abilities—the calculation of a smooth line transition between two sets of coordinates. In the conventional animation process, the highly paid animator actually makes only a few key drawings for each sequence—the images representing the beginning and end points of the movement. Lesser-paid "in-betweeners" are then given the task of creating the succession of drawings that move the character between the key frame positions. The electronic program, however, can eliminate the in-betweener altogether. Only the key frames are scanned into the database; mathematical-interpolation programs then move the character from one key frame position to the next in whatever time the animator specifies.

Where might all these developments take us? Television, with all its budgetary limitations, may have reached its ultimate computer-graphics level if the H-B project becomes a production reality and is put on line to help create some of the tens of thousands of feet of animation footage H-B puts out annually.

But not so the movies, in which there seem to be few budgetary restraints. Digitally created special effects have already been seen in Michael Crichton's *Looker* and abound throughout the Walt Disney Productions film *Tron*. But the next evolution will come soon—most likely first from the team of Smith and Catmull at Lucasfilm, but not quite in time for the *Revenge of the Jedi* episode of Star Wars.

Imagine that the background being scanned into the computer is not a silly cartoon image but a rendering of an alien planet's snow-capped mountains. By programming the computer, the artist is able to shift the light intensities slightly every time the image is displayed, creating an eerie flickering effect in the methane snow. Now imagine that instead of Fred Flintstone or Barney or Sylvester the Cat, the foreground image being scanned into the computer is footage of the actors and actresses. The same programs that enable the merging of the cartoon characters can be applied to the real scene, placing the performers into a digitally manipulated image of the alien planet.

Finally the datastream of the composite image is used to modulate a laser beam that translates the data into a 35mm motion-picture frame, the system's resolution so high that it is above the resolving power of the grains of film themselves.

If the television and film media are in the business of creating illusions and magic, then surely the best is yet to come. ∞

*"The good news is, We're biodegradable."*

CONTINUED FROM PAGE 28

to play Bob Hope's stunt double told me that there was even a double for the stunt dummy, but that day the stand-in's stand-in was apparently sticking close to its "plush" film people's jargon for a Winnebago motor home.

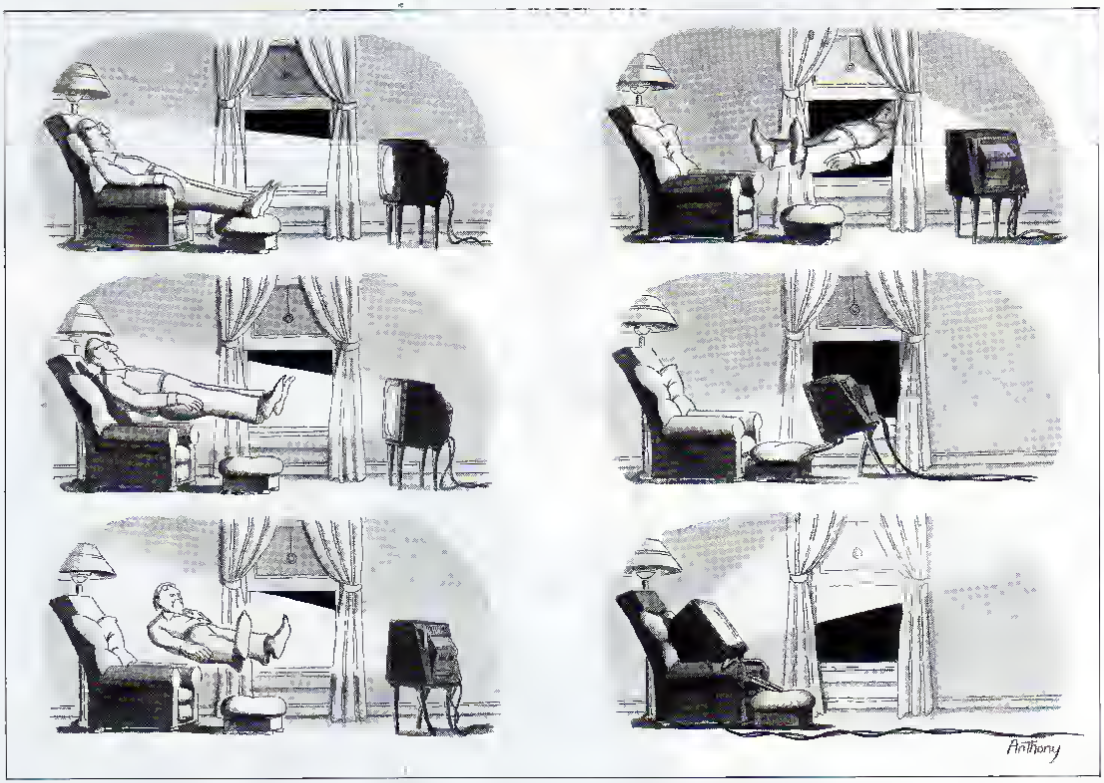
The more I spoke with cast and crew, the more I understood that everyone was slightly bananas, having been hard at work in the hinterlands of Wyoming and Colorado for three months. Sound mixer Jim Tannenbaum confided that the crew had nicknamed the picture "Endangered Movie and "Altered Steaks." During a break between scenes, stars Robert Urich and JoBeth Williams sang an impromptu duet of "As Time Goes By," while Bob twirled a neutered .357 Magnum snubnose and Rosetta Anderle, Colorado's first lady sheriff, laughed nearby.

The stuntmen meanwhile, sporting T-shirts with legends like "Kill 'Em All, Let God Sort 'Em Out," spent most of their off-camera time playing poker. One of the mercenaries, John Barlow, actually writes songs for the Grateful Dead and owns a ranch near Pinedale, Wyoming; two of his own cattle had been mutilated there. John's steady hands earned him the role of mercenary surgeon, and he spent several long hours in the back of the Trans-Allied Grain and Storage trailer truck dissecting dead cows with a Coherent Systems $CO_2$ surgical laser. Forgoing the smoke and the stench of searing hide and flesh, I observed John's performance in the following morning's dailies. I also missed the scene in which Hoyt Axton, who plays Morgan, a community pillar, is eaten alive by deadly bacteria that have been injected into his toothpaste by his erstwhile mercenary allies. In the scene, Hoyt staggers from a pickup truck, bleeding from the ears and mouth, clawing at his belly, which finally breaks open, covering the highway with a grisly smorgasbord of pig guts, sausage links and cold cuts. The lunch line that day was shorter than usual, and the chef reported a big run on yogurt.

I was, however, present for the nocturnal cow drop. Everyone gathered around a decidedly undistinguished-looking mud puddle outside the sugar mill. In the harsh brilliance of bulb man Tommy Thatcher's helium-mercury-iodine lights, a frozen cow was dangling from the boom of a crane 15 feet over the murky water. Suddenly the mercenaries' "silent" helicopter, a modified Bell 204, hovered above the suspended body to make future filmgoers think that the cow is actually hanging from the chopper. At the given signal, an explosive bolt blew, and the carcass slammed earthward, missing the puddle by a good five feet. Amid a din of rotor roar and cursing, the carcass was hooked to the crane which lifted and swung it into a waiting refrigeration truck. A second cow, mudless and frozen, was then removed from the truck and hoisted into position. As the Bell hovered again, the second cow performed a perfect swan dive to wild cheers and vigorous applause.

Very few of the cast, and virtually none of the crew, believe that cattle mutilations are for real. By the time I leave the set of *Endangered Species*, I, too, am no longer sure that they exist. In spite of my mountainous files documenting all my years of mute enthusiasm, I must confess that I have never seen one in the flesh. And after my several days among these masters of illusion, I accept the possibility that the mutes may after all be a Tinseltown sham.

Before Rubin dropped me at the airport, he drove fellow reporter Ginger Varney and me to station KMGH-TV7, in Denver. For the next two hours, Steve, Ginger and I sat spellbound, watching *A Strange Harvest*, Linda Howe's Emmy Award-winning documentary about the real mutilations. When the lights finally came up, my throat was dry, a pall hung over the room. The film galvanized every bit of "mute" lore adrift in my brain, and I emerged a mute man reborn. As I hefted my bags, I scanned the blue midmorning skies, renewed, revitalized, and once again afraid. ∞



# COMPETITION

CONTINUED FROM PAGE 156

celebration Young men showed off their valor competing for prizes During these so-called Valiant Times a triumphant lad ordinarily did not keep his token of victory but gave it to the girl he fancied Valiant Times live on in the observance we now call Valentine s Day

*—Will Hoskins Heiskell Tenn*

BRA An acronym for Breast Remolding Apparatus first sold through the Sears Roebuck catalog in 1908

*—Willie K Friar, Balboa Heights, C Z*

OBSCENE Derived from the early days of motion pictures when the Hays Office censored those portions of movies that were considered unsuitable for the general public The segments to be cut were called "objectionable scenes" which was eventually contracted to "obscene"

*—Michael Niemi Republic Mich*

CONDOMINIUM From *condom* ("child free") and *dominion* ("autonomous")

*—M Cristofer Field, Mount Holly Vt*

CANADA From the roots *can* (a container) and *nada* ("nothing") meaning an empty container This derogatory description by an early explorer was later adopted with pride by the country (Compare Bob and Doug MacKenzie)

SASKATCHEWAN A variant spelling of *Sasquatch haven* so named because of early sightings of Bigfoot in the area

*—Ron Gray Garland, Tex*

DIET As every calorie counter knows this word is derived from the verb *to die*

*—James Austin Potomac, Md*

COMPUTER From the Latin roots *compos* for "knowledge" and *uteri* for "reservoir"

*—Don G Pierson Bowling Green Ky*

RUBE From the Latin root *rube* originally referring to the red faces and necks of country folk

*—Ray Franklin Fort Collins Colo*

OMNI An acronym devised by publisher Bob Guccione for (1) Our Magazine Nullifies Ignorance or (2) Observe Man's Noble Innovations

*—(1) Carl Carson, Riverside Calif, (2) Mark Sternberg Denver*

R S V P Not an abbreviation for *Repondez s'il vous plait* as commonly believed The original meaning was (1) Reply Simply Via Postcard or (2) Remember Send Valuable Present

*—(1) Peter Labonte, Berlin, N H (2) Beverly Fogarty Ludington Mich*

PDQ Erroneously assumed to abbreviate "Pretty damn quick" it originally stood for the Latin *Per Di Quacumque* which translates "By the gods any way possible

*—Ellsworth "Dutch" Nelson Colorado Springs, Colo*

HEP Originally from the military command "Step two three four," shortened to "Hep two three four" The Jazz Age expression "I'm hep" thus meant "I'm in step"

*—Sandra Zorn, Minneapolis*

HOOCH (1) Slang for ethyl alcohol derived by transposition of letters from its chemical formula $C_2H_5OH$ (2) For similar reasons alcohol was originally spelled *alchohol*

*—(1) Ralph Stepnen Newcastle England (2) Carole Carpenter O'Fallon Mo*

KINDLING From German *Kindlein* meaning "little child," so called because the kindling used for starting a fire is made up of smaller sticks

*—Keith Ammann Evanston, Ill*

SPUDS During World War I a potato distributor divided his product into bins marked "Prime" and "SPUDS" (for Some Potatoes Under Desirable Standards) The latter were sold at a discount rate to the Army

*—Daniel L Swetman, Chicago*

BREAK A LEG. The actors' good-luck wish can be traced back to 1865, when actor John Wilkes Booth, after shooting President Lincoln, jumped to the stage caught a spur on the American flag next to the President's box, and broke his ankle.
—*Joel Popp, Clearwater, Fla.*

MATRIMONY. Combined form of the words *mattress* and *money*.
—*J. L. Nowak, Nakusp, B.C., Canada*

CONGRESS. Describing the actions of elected representatives, the opposite of *progress*.
—*Kelley Rogers, Noti, Ore.*

TOMATOES. Once considered poisonous, they were called love apples and were grown as ornamentals in American colonial gardens. Thomas Jefferson proved the fruit both harmless and delicious by publicly consuming it. Afterward people seeing the plant, would point and say, "Tom ate those."
—*Darrin Duling, Richmond, Va.*

TOAST. Acronym for *To Offer a Short Tribute*.
—*William H. Bergh, Tulsa.*

FIAT. Acronym for the command given to an Italian mechanic, "Fix it again, Tony."
—*David S. Lione, Bartlesville, Okla.*

EXPERT. Derived from ex (a "has-been") and *spurt* (a "little drip under pressure").
—*Charles Keller, Wichita.*

MONSTER. Originally a description of the Cyclops of Homer's *Odyssey*, from *mono* ("one") and *stare* ("evil eye").
—*James K. Woolsey, Nashville, Tenn.*

GRINGO. Derogatory term for Americans derived from the first words of the song "Green Grow the Lilacs," which the Mexicans heard the Americans singing during the siege of the Alamo.
—*Kenneth Muehlenbein, New Milford, Conn.*

MULE, MALE. I once heard a misogynist argue that *mule* comes from the Latin *mulebris* ("womanly," as in *mulebrity*). A staunch feminist countered that *male* obviously stems from the Latin *male*, meaning "badly" or "insufficiently."
—*Brian Rice, Shelby, N.C.*

BARGAIN. When the barter system was used in business, the party who made the better deal was said to have had a "barter gain." This was later shortened to *bargain*.
—*Al Valentino, Red Bank, N.J.*

SCI-FI. An ancient term, originally used by Lucian of Samosata to describe his book *True History*. He called this type of fiction ψ φ (psi phi), an abbreviation for *psycheoun philia* ("love of things of the soul" or speculation for its own sake).
—*Paul Marxen, Lake Zurich, Ill.*

EMBARRASSED. Originally the state of being caught with one's pants down.
—*J. R. Davis, Silver Spring, Md.*

SOUSA, JOHN PHILIP. Originally John Philipso the march king altered the spacing of his last name and added the letters *usa* in a spirit of patriotism.
—*Kim Vandermolen, Columbus, Ohio.*

ATHLETE. A competitor in the Olympic Games, held in Athens, Greece.
—*Gustavo Matheus, Potomac, Md.*

AHOY. Short for *All hands on yardarm!*
—*Carole Carpenter, O'Fallon, Mo.*

ATONEMENT. The original meaning was living "at-one-ment" with God.
—*Jane Smoley, Fort Bragg, Calif.*

CATER (as in "cater to"). Originally pronounced *cat-er*, it described the way domestic cats prefer to be treated.
—*Mary Taggart, Minneapolis.*

RADAR. Acronym for *RAndom Dispersal and Retrieval*.
—*Doug Flaugh, West Lafayette, Ind.*

CONTINUED FROM PAGE 156

and mysteriously Schoelkopf who commuted regularly to the Mystic Seaport aquarium to visit the recuperating cetacean, believes that the animal's release was delayed too long. A grant for the venture was at last authorized. Ironically, the day after the animal had died. Schoelkopf does not blame the Mystic personnel, whom he considers among the finest in the business. Nonetheless, he can't help wondering: Had he been there, would the outcome have been different?

Liberating a recovered marine mammal is a costly and delicate operation, and Schoelkopf often goes to extraordinary lengths to ensure the survival of the creatures that he rescues. To free the harbor porpoise, he and other volunteers chartered a plane from Atlantic City to Cape Cod. On another occasion he drove a loggerhead turtle, an endangered species, to a temperate beach in Florida.

In the daily routine of the Stranding Center, friends and supporters help with tasks ranging from typing address labels for the newsletter to rummaging through garage sales in search of needed equipment. Guests are welcome to visit a current patient or sign up for special activities which include Cape Cod whale watches and local campouts complete with a course in marine mammal first aid.

The Stranding Center maintains a 24-hour whale hotline, and the organization's members are often called upon to animal-sit. Should an emergency arise, a sociable Sunday afternoon get-together can easily culminate in a maritime rescue or—more usually—an autopsy.

Schoelkopf routinely examines every sea mammal that washes up on the New Jersey shore. Records are kept, and data and tissue samples are forwarded to the Smithsonian and other institutions. For the past three years the Stranding Center has also conducted heavy-metal tests. Results to date indicate that a higher concentration of mercury is present in the tissues of deep-sea creatures than in those that hug the shore. Mercury poisoning has been linked to disorders of the human central nervous system, such as the Japanese Minamata disease. Since marine mammals eat the same seafood we do, the implications are unsettling. Schoelkopf, however, will draw no rash conclusions. Before he can establish that mercury levels are dangerous, he must first determine a baseline criterion for normalcy both in the region and in the species. The cost of this extensive research is far beyond the Stranding Center's strained operating budget.

Until recently the center was aided by intermittent government funding, but federal cutbacks have now totally eliminated this vital stipend and have forced a temporary closing of its Gardner's Basin whaling museum, a natural history exhibit of past exploitation and present hope.

The center's sole source of income is the donations that trickle in from its membership. Unsalaried, Schoelkopf receives a moderate sum as a state conservation officer and supplements this with lecture engagements at nearby schools. For the marine-life protector, the work in itself is the chief reward.

Last spring the harbor porpoise Schoelkopf had nursed back to health was taken to the hospitable waters off Cape Cod. Not long before, the plucky animal had been a shivering invalid that experts dismissed as "beyond help." Now it had to be gently restrained till the opportune time.

Schoelkopf could feel the strength and vigor in the porpoise's body as it responded to the nearness of the sea. When freedom came, the porpoise leaped from the boat and effortlessly joined its kinfolk in the Atlantic—an exhilarating moment for Schoelkopf. This is, after all, what the Stranding Center is all about. Still, releasing his charge was like bidding good-bye to a beloved companion. If recovery was complete, there would be no further meeting. Best this be the final farewell. ∞

*For membership information contact the Marine Mammal Stranding Center, Historic Gardner's Basin, Atlantic City, NJ 08401. Tele: 609-348-5018.*

# THE BODY

CONTINUED FROM PAGE 26

chemicals and their receptors that carry information about an imagined illness into the immune system

In order to find out how important these receptors are to immunity Strom and other scientists have mixed various brain chemicals with immune cells in laboratory dishes Many of the chemicals turned out to pair off with receptors in the immune system and some changed the activity of white blood cells, one of the system s chief weapons against disease Carried to the immune cells through the bloodstream these chemicals may play an important role in the body s defense against cancer and other disorders Strom is quick to caution however that "brain chemicals seem to be a vital adjunct to immunity but we must be careful not to assume that they mastermind immunity

The biochemical interactions between mind and immunity that these scientists tested varied enormously For example acetylcholine—one of the commonest brain chemicals—activated killer T cells ' which search for and destroy cancer cells In contrast epinephrine, dopamine and prostaglandin—brain chemicals often produced during stress—suppressed the immune cells that produce antibodies leaving the body susceptible to illness It is likely scientists say that many other such interactions will be traced to brain chemicals yet unknown

It seems that brain chemicals may also be channeled directly into the immune system by specialized nerves Photographs of tissue from such immune-system organs as the spleen lymph nodes and thymus show what appear to be nerve fibers coupled to the immune cells Exactly what chemicals are relayed back and forth along these fibers and what effects they have must still be discovered

PNI may turn out to be the trail-blazing field of the Eighties just as genetics was in the Seventies As more brain chemicals involved in the immune system are understood methods will be found to turn them on and off, opening new ways to control disease Drugs that mimic brain chemicals seem the most obvious hope but brain surgery may be another more drastic possibility surgically tampering with specific areas of the brain can significantly affect the immune system Deep-relaxation techniques, too, have been found to modify certain brain chemicals It may even be possible to create a sophisticated biofeedback setup linked to a blood analyzer so that patients can be trained to crank out more antibodies or white blood cells at will

These new therapies could arrive much sooner than we might expect As Ader says, "Everybody is grabbing whatever piece he wants from psychoneuroimmunology and running with it We re a new science moving at a phenomenal rate





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# FORUM

CONTINUED FROM PAGE 12

### Lepidopterist Demurs

The splashing photograph of an African swallowtail butterfly [Phenomena, August 1982] is a credit to Károly Buday, who confessed to have a passion for photography "on a small scale." The small, pigmented scales clothing the bodies of moths and butterflies have made them a favorite photographic subject.

As a matter of taxonomic correction, the butterfly illustrated is *Ornithoptera priamus*, one of the several species of birdwing butterflies that are found in the Indo-Australian Archipelago.

Karl Dyarski
Starkville, Miss.

### Fire Fighting

In "Fighting Fire with Fire" [Earth, July 1982] the author, Mr. Mark Teich, mentions "mastering new devices like the helitorch." Maybe that is true for California wildfire suppression, but the device is hardly new.

In 1975 the Gifford Pinchot Forest in Washington, tried the helitorch for use in controlled burns. At that time the torch's firepower was a mixture of gasoline and diesel fuel. For several years before that time, Canadian authorities and industry had been using the torch.

In 1978 the Siuslaw National Forest, in Oregon, decided to try the helitorch for its burns. First the gas/diesel mixture was used, and soon experiments with alumagel were undertaken.

The "flying drip torch" has proved itself a useful tool in areas notorious for thick brush. It is also a safe alternative to sending people into an area that is too hazardous to hand-light.

Use of the helitorch as a backfiring tool on wildfires may indeed be new, but it is well known and used in the Pacific Northwest's forests.

Bev Reed
Alsea, Ore.

### Anyone High?

In his column "Baker's High" [Continuum, August 1982] Mr. Allan Maurer reports untenable conclusions by nutritionist Dr. Ralph Price concerning homemade rye bread contaminated with ergot. Evidently Dr. Price's analysis of homemade rye bread showed the presence of ergot, which is not unusual. If the bread caused psychotropic effects, this would be owing to certain natural psychoactive constituents of ergot, such as lysergic acid amide and lysergic acid propanolamide.

When heated, natural ergot alkaloids are not transformed into LSD (lysergic acid diethylamide), which is an artificial compound. Rather, owing to the great instability of this substance, LSD could not be expected to survive the high temperature of baking, even had it been present.

Furthermore, the poisoning episode to which Dr. Price refers, in the French city of Pont St. Esprit in 1951, has been shown to have been caused not by ergot but by an organic mercury-compound used for disinfecting seed—a fungicide.

This conclusion was reached by no less an authority than Dr. Albert Hofmann, discoverer of LSD and the world's leading authority on ergot alkaloids, who analyzed samples of the bread from Pont St. Esprit and also autopsy samples of the few victims who succumbed.

Jonathan Ott
Vashon, Wash.

### Brainy Assumptions

*Omni*'s August coverline "First Photos of the Mind" apparently referred to the pictures on page 69 and following.

Very impressive. Complaint, however: To neglect any distinction between the brain and the mind is to assume that an ancient question has been settled. A scientific magazine should assume nothing.

John Walker
Lansing, Ill.

### Engineering Manpower

Mr. Arnold R. Deutsch missed a very important point about engineering man-

*"He's had a lot of near successes—the cube-point pen, the ice-skateboard, the mood bracelet, the milk pic, the digital sundial. Now he's working on lunar energy."*

power [First Word, July 1982] Though there may be a chronic shortage of engineers, there is also a chronic shortage of employment opportunities for recent graduates such as me

Before anyone studies the problems of how to provide industry with more engineers and how to provide these engineers with a better education, a more important study should be conducted on how to provide engineering graduates with jobs

Arvid C Berg
Willingboro N J

### Capitalize Space

Thanks to Len Hilts for his excellent article about the space shuttle school [Space, August 1982] It is refreshing to hear of civilian space activities when so many space activities seem to be military Nonmilitary use of space can in the long run lead to a significant migration of people from Earth to space to mine materials and to produce goods and perform services not available at present here on Earth

We appreciate the factual information in Mr Hilts's article but we disagree with the following statement "How long the development of space takes and when private space ventures become profitable depend entirely on government willingness to support the [space shuttle] program"

First of all the U S government is not the sole institution capable of financing a space transportation system Funds that would be sufficient to build space transportation systems are also available in several private institutions

All taxpayers, whether they care to or not support the space program But they have no control over how their money is spent Those truly interested in a space program will realize that the government-run space program is inherently irresponsible and inefficient Private enterprise would allow individuals to spend their money on projects that they support

Thomas Coughlin and
Fiammetta Zahnd
Minnetonka Minn

Students for the Exploration and Development of Space (SEDS) is a growing international student society with 116 chapters in the United States and 5 chapters in foreign countries Founded in 1980 on the campuses of Massachusetts Institute of Technology and Princeton University SEDS quickly grew to its present size

This enthusiasm has stemmed largely from the realization that the lack of aggressive space goals and the steady deterioration of existing programs endanger our future and demand an organized response from the world s campuses

Our primary interest is the education of the world s students about space and its benefits, and we encourage governments and private industry to invest now for the future For information about forming a chapter at your college please write to

SEDS International
372 Memorial Drive
Cambridge, MA 02139

Peter Diamandis
Cambridge, Mass

We should all join in congratulating those men in Texas on their first successful launch of the *Conestoga* This certainly heralds the most promising program the space effort could possibly hope for

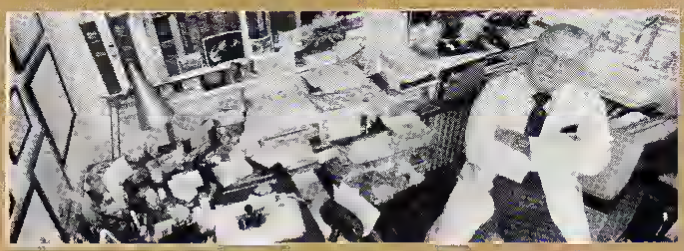
Reminiscent of the days when the adventurous wildcatters roamed Texas in search of oil the men of *Conestoga* embody the true spirit and enthusiasm we all need more of I sincerely hope that anyone in a position to help them (and make a damned good investment besides) will rally quickly to their cause

A special debt of gratitude goes to Deke Slayton for getting involved We need more men of his daring and stature to help take us to the new frontier And ultimately a warm thanks to the National Aeronautics and Space Administration which really got the ball rolling The achievements of the people involved will go down in history as the best thing mankind has ever done It is indeed an exciting time to be alive

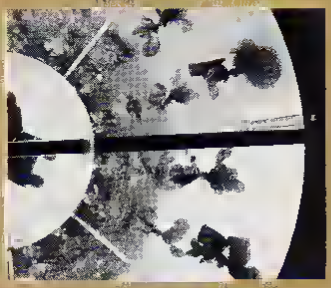
Pete R Miller
Bellevue Wash


*"It seems that whenever I start talking, people just get up and walk away"*

# NEXT OMNI



FEAR



EDEN

FICTION

**FEAR AND FERTILITY IN LAS VEGAS**—North of the majestic gaming palaces untouched by the conspicuous ebb and flow of cash in casinos the Star Clinic struggles to improve the odds for life At seventy-three the clinic's director Dr Landrum Shettles was doing what he had always done trying to manipulate the odds enabling conception to occur Yet despite the extraordinary success of such books as *Choose Your Baby's Sex* Dr Shettles was not assured of winning *Omni*'s sensitive portrait of an important and controversial obstetrician reveals his enduring dreams of embryo transplantation Readers will also share Dr Shettles's brave new plans for human cloning using the nucleus of a sperm cell

**LUNAR HABITATS**—An airless chunk of rock hardly qualifies as prime real estate but—pardon the cliche—it *does* have potential Not only does the moon command a breathtaking view of Earth, but its soils are rich in minerals and other materials essential for life A team comprising NASA engineers and university ecologists and climatologists is quietly working on a scheme that could transform the barren lunar landscape into a flowering oasis—a self-supportive habitat fit for man The next great extraterrestrial migration is discussed in the December issue

**TOMORROW'S EDEN**—The plants spin in drums, glide through humid air on conveyor belts, float on water and drop ripe fruit into ponds of lively fish Straw-colored roots swinging freely glisten with freshly sprayed nutrients This fertile, kinetic garden—on display in next month's *Omni*—is the province of some 60 researchers at the University of Arizona's Environmental Research Laboratory They're cultivating more than crops Ideas nurtured here may save vast amounts of space on future Earth farms and probably will help farms take root in space

**FICTION**—The unthinkable has happened Nuclear war between the United States and the Soviet Union has broken out and devastated both countries A handful of American survivors makes it to the shores of Mother Russia hoping to start a new civilization only to discover the past doesn't die easily Read Ian Watson's chilling story "Returning Home" An unlikely couple finds love and happiness in Thomas M Disch's romantic little yarn "The Shirt's Tale the Shorts Story" Last but not least, *Omni* is delighted to welcome back Orson Scott Card who has returned from his science-fiction-writing hiatus with an exceptional story "The Changed Man and the King of Words" In it, a genius son causes serious problems for his family when he discovers a link between tarot cards and computerized fate



## BREAKTHROUGHS

CONTINUED FROM PAGE 38

Communicator's eclectic musical selection includes rock, pop, soul, Motown jazz and country-western embellished with video material ranging from live concerts to conceptual art pieces ($10,000 from Video Music International, Inc., 1647 Woods Drive Los Angeles, CA 90069)

If office products ranging from word processors to computer terminals are becoming household appliances can copying machines be far behind? Not if Canon USA, Inc., has anything to say about it Canon's latest copier said to be the world's smallest and lightest is the first to use a replaceable cartridge that contains all the necessary copying elements—including the photosensitive drum, the charging device, toners and cleaners The plain-paper copier, which weighs about 50 pounds, has one other surprising feature It copies in three colors—brown, blue, and black Prices for the PC-10 and PC-20 models have not yet been set (Canon USA, Inc., Copier Division, 1 Canon Plaza, Lake Success, NY 11042)

Many joggers in northern states take winter months off, driven sedentary by cold air that stings the nostrils and tightens the capillaries A new device called Body-breather uses body heat to warm air before the runner inhales it through a snorkellike mouthpiece Its designers say the 4 3-ounce air warmer, worn like a bib over the chest, raises the temperature of air drawn into it by about 55°F, making winter running more comfortable Fresh air enters through one valve, the runner exhales through the other Valves permit air flow with minimal drag The flow heats up within two minutes, according to the manufacturer ($47 69 from Xinox Corporation, 85 Watermill Lane, Great Neck NY 11021)

A new computer and communications company is making plans to offer software by subscription via the satellite transmission facilities of National Public Radio Subscribers would pay between $40 and $50 a month in return for 50 to 60 assorted software packages including video games delivered to their home computers Software-by-subscription will be an outgrowth of a new partnership announced last summer between the nonprofit National Public Radio and the new National Information Utilities Corporation, a private company in McLean, Virginia The corporation plans to transmit digital data over unused portions of the radio network's FM carrier signal bounced off satellites In a system designed by Stephen Wozniak, a cofounder of Apple Computer, Inc., software would be loaded rapidly through a decoder into the memories of subscribers' home computers during offpeak hours, with the regularity of a Sunday newspaper (1600 Anderson Road, McLean, VA 22102)

WHEN THEIR SKY BEGAN TO BURN, WHO
COULD BLAME THE RUSSIANS FOR THINKING THAT
THE AMERICANS HAD ATTACKED...?

AFTER MILLENNIUM, COMES THE

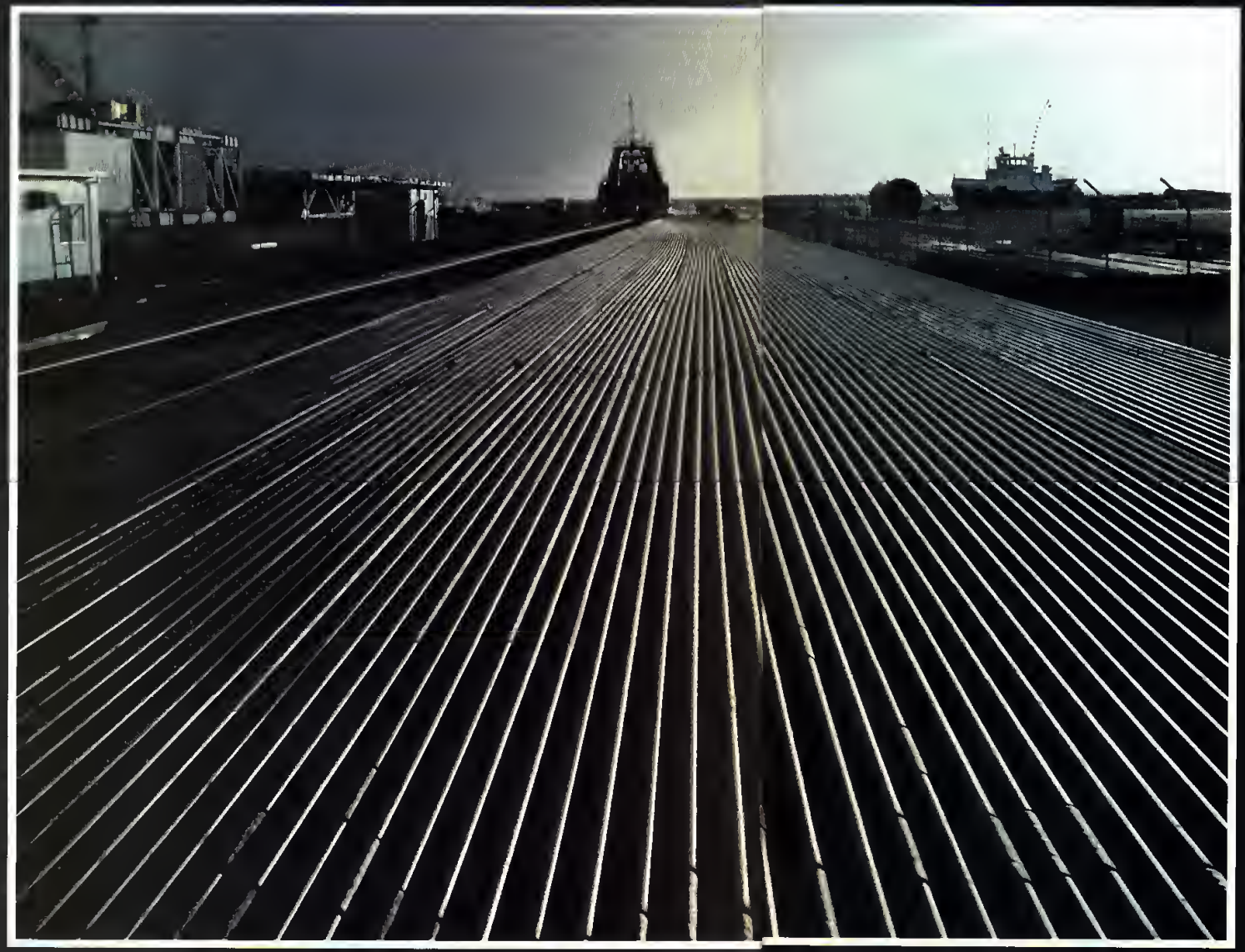
# TEST OF FIRE

# BEN BOVA

By the multiple Huga winning authar af KINSMAN, MILLENNIUM and COLONY, and the Editar in charge af the world's highest circulatian science and science fictian magazine OMNI

TOR

WE'RE PART OF THE FUTURE.



# PHENOMENA

The early-morning sun glints off rows of black pipe, pieces of a flexible steel artery that will eventually connect an offshore drilling rig, near the coast of southeastern Australia, to the mainland. Photographer Anthony Wolff captured this vista while on a visit to an Exxon oil-rig factory at a place called Barry's Beach, just east of Melbourne. He thought one of the more fantastic parts of the operation was the way the ship in the distance would roll a piece of pipe, each 1,000 feet in length, onto gargantuan spools like so much thread. As each was being wound up, another would be welded to its end, and the operation would continue this way until the ship had 20 miles of the plastic-coated pipe on its spools. That 20-mile length would then be hauled out to sea and laid on the ocean floor. Wolff recorded this perspective on Kodachrome 64 film, using an extreme-wide-angle lens on his Nikon camera.

# GALACTIC HOLE

# STARS

By Terence Dickinson

Nestled on the inner edge of one of the Milky Way's pinwheeling arms is the star we know as our sun. From our vantage point orbiting that star, the galaxy's nucleus lies 30 000 light-years away, in the direction of the constellation Sagittarius. There the naked eye perceives only a gentle brightening of the Milky Way, but astronomers have long known that this central zone contains billions of stars shrouded from our view by intervening nebulae of cosmic gas and dust. Since light from this galactic core is blocked from view, several teams of astronomers have studied it by resorting to combining the evidence obtained from telescopes with evidence from detectors sensitive to radio, infrared, and gamma-ray radiation, which can penetrate this optical veil. They have gathered persuasive evidence that at its center the galaxy has a black heart—a million-solar-mass black hole, with an intense whirlpool of hot gas circling around it.

One piece of evidence comes from a group of researchers at Bell and Sandia laboratories who launched high-altitude balloons carrying gamma-ray detectors high over central Australia. Such high-altitude flights are necessary to measure gamma rays because the rays are absorbed by the lower layers of the earth's atmosphere. Since 1977 the instruments have recorded, during three flights, gamma radiation so intense that theoreticians say it could have been generated only on the superheated fringes of an accretion disk spinning around a massive black hole. (An accretion disk is a flat, circular accumulation of gas and dust that forms around a neutron star or a black hole and that, by its swirling action, becomes hot enough to emit X rays.)

This accretion disk model fits nicely with other findings from the field of radio astronomy. At a recent meeting of the American Physical Society, Robert L. Brown, a National Radio Astronomy Observatory astronomer, announced that American and European astronomers have mapped radiation from the nucleus of the galaxy. Their findings conform almost perfectly to theoretical models of the kind of radiation emitted by material swirling around a massive black hole.

This conclusion is supported by other recent observations made with the new United Kingdom Infrared Telescope at Mauna Kea, Hawaii. There British astronomer Ian Gatley has found evidence of a ring of heated dust surrounding the nucleus of our galaxy. He says the ring's radiant output, measured in infrared radiation, is several hundred million times that of our sun. The power source that could heat dust to such levels, according to him, cannot be attributed to stars. It would take 1,000 young, luminous stars jammed into a volume one light-year across, he explains, and nothing approaching such stellar crowding is known or seems even possible. What is more likely is that the source is a relatively small, but enormously powerful, object—a supermassive black hole.

Astronomers also say the pressure of radiation emerging from the vicinity of the black hole's nucleus would inevitably change in the course of time as the hole ages. Occasionally an enormous amount of material—perhaps an entire star—might plunge toward the hole, causing a surge or burst of radiation—similar to the effect you get when you throw gasoline onto a fire. This would blast more distant material, which until then had been drawn toward the hole, farther out into the galaxy. In fact the radio-astronomy teams have detected doughnuts of material ejected from the galaxy's center, like smoke rings, something Brown attributes to these periodic eruptions. Probably the maw of the galaxy hiccups every few thousand years.

Astronomers now are leaning more and more toward these supermassive black holes as the explanation for the prodigious emissions of energy from the hearts of other galaxies and of quasars, which are widely believed to be eruptive galactic nuclei. Brown says it is possible that in times past violent blasts rocked our galaxy and that they may do so again in the future. But, he adds, there is no cause for alarm. "Compared to quasars and some other galaxies, the Milky Way is quite sedate."

*Beyond a veil of interstellar dust and gas, does a supermassive black hole lurk at our galactic core?*

*Paradox lost*
*and paradox regained*

# GAMES

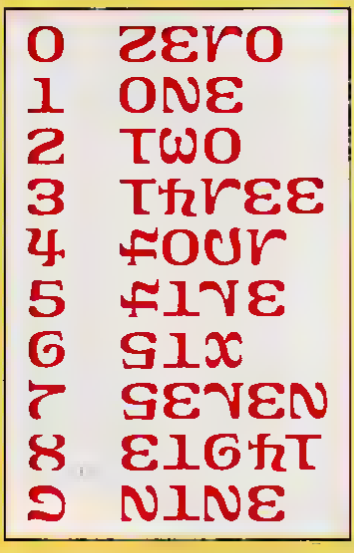
By Scot Morris

In 1978 Martin Gardner published a charming little volume entitled *aha! Insight*, a collection of playful problems that yield to the sort of sudden solution that psychologists call an 'aha! experience.' This year the sequel and companion volume *aha! Gotcha* appeared, and this month's column is adapted from it. Both books are published by W. H. Freeman and Company, San Francisco.

The chapter openings in *aha! Gotcha* are by Scott Kim, an artist familiar to readers of this column. His best, in our opinion, is the elegant table of numbers reproduced below.

The book is not merely a compilation of puzzles and answers, but a wide-ranging look at paradoxes—some of which have no simple solutions—and curious observations with a mathematical twist.

One of the earliest logical paradoxes was attributed to Epimenides, the Greek poet who lived in Crete in the sixth century B.C. and who said, "All Cretans are liars." The sentence is not self-contradictory, yet it is neither true nor false.




The enigma even appears in the New Testament, in Saint Paul's epistle to Titus:

> One of themselves, even a prophet of their own, said, the Cretans are always liars, evil beasts, slow bellies.
> This witness is true.
>
> —Titus 1: 12-13

Whether Paul realized the statement was paradoxical is not known.

Closely related are the bumper stickers that read BAN BUMPER STICKERS, George Bernard Shaw's assertion that "the only Golden Rule is that there are no golden rules"; and Groucho Marx's vow that he would never join a club that would have him as a member.

> There was a young lady of Crewe
> Whose limericks stopped at line two.

There's nothing paradoxical about this anonymous limerick, but what about the sequel?

> There was a young man of Verdun

A UPI story dated April 24, 1970 reported that political candidates in Oregon were allowed to put 12-word slogans under their names on the ballot. Democrat Frank Hatch, of Eugene, who ran for Congress, used this slogan: "Anyone who thinks in 12-word slogans should not be on this ballot."

Self-reference can be amusing even when it isn't paradoxical. In the index of Paul R. Halmos's *Finite Dimensional Vector Spaces* there is an entry: "Hochschild, G. P., 198." Hochschild is nowhere mentioned in the book, except in this entry, which is on page 198.

One type of paradox arises when things are divided into classes. For example, some scientists are interesting (those who have been the subject of *Omni* interviews, for instance), others are dull. If we list all the world's "interesting" and "dull" scientists, someone will be at the bottom of the "Dull" list. Being "the dullest scientist in the world" is certainly an interesting thing to be. If that scientist is moved over to the "Interesting" list, does that make the scientist who was formerly next-to-last on the "Dull" list now interesting? If so, the argument can be repeated again and again until we have proved that "All scientists are interesting"—a proposition that is doubtful at the very least.

G. G. Berry, an Oxford University librarian, once pointed out to Bertrand Russell a paradox concerning "the smallest integer that cannot be expressed in fewer than thirteen words." What integer does this 12 word sentence describe? Does it belong to the set of integers that can be expressed in English with fewer than 13 words, or to the set that requires 13 words or more? Either answer leads to a contradiction.

The philosopher Max Black posed a variation similar to this. Several different integers are mentioned in this issue of *Omni*. Fix your attention on the smallest integer that is neither mentioned nor referred to in any way in this magazine. Is there such an integer?

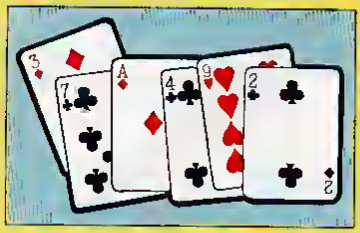
Here are some more puzzlements adapted from *aha! Gotcha*.

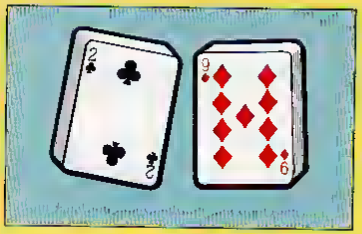
1. WILLIAM JAMES'S SQUIRREL. The philosopher William James met some friends camping in the woods and found them in the middle of a heated argument. It seems that one of the men had come upon a squirrel clinging to a tree trunk. As the man circled the tree, the squirrel did the same, so that it always faced the man. After going once around the tree, they were both back where they started. It was clear that the man and the squirrel had both gone around the tree. The question was, Did the man go around the squirrel?

One group said, "Of course. The man walked a big circle, and the squirrel was always inside it, so the man must have gone around the squirrel."

The other faction argued just as heatedly. "Nonsense. Even if the tree hadn't been there, the man would never have seen the squirrel's back. How can you go around anything without being on all sides of it?"

James settled the argument by explaining it was a matter of semantics. How did he resolve the debate?





2 CARD TRICK Arrange a deck of cards so that the colors alternate red and black all the way through Cut the deck into two piles making sure that the bottom cards of the two piles are different colors Now shuffle the half-decks together with one thorough riffle shuffle Take cards from the top in pairs If I offer to pay $1 for every pair in which the colors are different and to take $1 for every pair of a single color would you take the offer? Approximately how much would you expect to make or lose on this bet? Or should you break even?

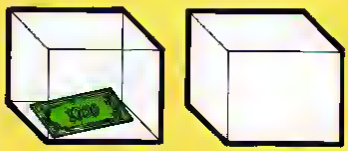
3 THE UNEXPECTED TEST On a Friday Professor Klemke told his logic class that on one of the days of the following week there would be an unexpected examination He assured his students that no one could deduce the day of the examination until the day it occurred Nevertheless he said if anyone could predict the chosen day with airtight logic the quiz would be canceled

The students got together for a cram session on Sunday night One of them argued There's no point studying Klemke can't keep his promise The exam can't be on Friday, because if we go through the week to Thursday and there is still no exam we'll *know* it is scheduled for Friday Since it won't be "unexpected" the test will have to be called off The last possible day, then, is Thursday But if there has been no test by Wednesday we'll know it is due on Thursday'

By similar reasoning the student proved that the exam couldn't occur on Wednesday Tuesday, or Monday Confident of their logic the students set their books aside and had a beer-and-pizza party

The students went to class the next week, smug with the knowledge that they had cracked the professor's little puzzle On Wednesday the professor said "Get out your test booklets Today is the day" The students were shocked The test surely was unexpected What went wrong?

4 THE RUBBER ROPE A worm is at one end of a rubber rope The rope is one meter long The worm crawls along the rope at a steady pace of one centimeter per second After the first second the rope stretches like a rubber band to become two meters long After the next second it stretches to three meters then four meters and so on Will the worm ever reach the end of its rope? If so how long would it take?




5 NEWCOMB'S PARADOX Omega a superbeing from outer space has done extensive studies of the human brain He can predict with great accuracy what any person will do when given a choice between two alternatives He has given the following test to hundreds of people and has always predicted their choices correctly Now it's your turn

There are two boxes on a table Box A is transparent and contains a $1,000 bill You may choose either (1) to open both boxes and keep whatever you find inside of them or (2) to take only the contents of Box B

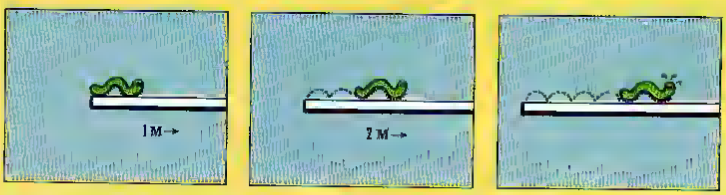
"I have made a prediction" says Omega "If I expect you to take both boxes, I have left box B empty you'll get only a thousand dollars If I expect you to take only box B then I have put a million dollars in it You get it all Which choice do you make?"

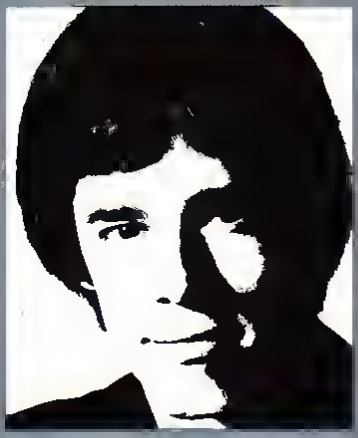
Some argue "In the past people who took both boxes got only a thousand I'll trust in Omega's superior knowledge, take box B and become a millionaire"

Others reason, "Omega has made his prediction and left Box B is either full or empty, it's not going to change So I'll take both boxes and get everything"

Which choice would you make? Both arguments can't both be correct Which argument is wrong? *Why* is it wrong?

Answers are on page 164





# LAST WORD

By Scott A. Piper

*"The kiddies could learn firsthand the horrors of nuclear war when a neutron bomb is detonated in Mister Rogers' neighborhood"*

In 1923 Westinghouse Electric employee Vladimir Zworykin, formerly of the Soviet Army Signal Corps, filed a patent application for a device destined to revolutionize society. His image iconoscope, the first practical television transmission tube, followed a year later by the kinescope, or TV receiver, established the inventor as the father of modern television.

Six decades afterward technological advances have led to tremendous improvements in broadcasting hardware. Unfortunately, broadcasting software has been impervious to attempts to change it for the better.

With another disappointing TV season at hand, perhaps it's time that money now spent on communications satellites and sophisticated fiberoptics be used to fund a *real* breakthrough—like an intelligent situation comedy, or a completely unbiased newscast. With that in mind, these suggestions, brought to you sans commercials, address some of the more pressing problems of the medium today.

*Children's shows.* With proper programming, the youth of America might develop something resembling a social conscience. For example, the kiddies could learn firsthand the horrors of nuclear war when a neutron bomb is detonated in Mister Rogers' neighborhood, giving the unlucky host a fatal dose of radiation but leaving the set unharmed. *Captain Kangaroo* might explore the moral implications of recombinant DNA research with the aid of Mr. Green Genes.

*Game shows.* Sophisticated statistical tests have revealed little correlation between intelligence and cash earnings on most quiz programs. To correct this imbalance, questions could be culled from standardized I.Q. tests, and verbose emcees could be replaced by experienced test proctors, thereby eliminating mindless chatter. Winners would be given full scholarships to the universities of their choice, while losers would have to console themselves with inexpensive correspondence courses.

*Alternative programming.* Networks could schedule an increasing amount of nontraditional programming—Easterns instead of Westerns, for example—to attract new segments of the population. *Little House on the Prairie* could be renovated to appeal to the energy-conscious. Pa Ingalls will be shown insulating and weatherstripping his way through the new season, gradually reducing his heating bill to a size more befitting the diminutive stature of his pastoral dwelling.

In addition, *That's Incredible* would be revamped and retitled *That's Mildly Interesting* so as to avoid upsetting people who have high blood pressure.

But the most exciting event of the new season would be a weekly series based on contemporary composer John Cage's celebrated work *4'33"*, a piece consisting entirely of 4 minutes and 33 seconds of silence. This landmark program, easily recognized by its distinctive theme music, would contain no sex, no violence, and not much else, making it the first show ever to receive the acclaim of both modern-music lovers *and* the Moral Majority. As an added bonus, viewers could save electricity by watching with the television turned off.

*Advertising.* The era of commercial telecasting was inaugurated on July 1, 1941, by station WNBT New York. The first commercial—a ten-second Bulova Watch Time announcement that was superimposed on the test pattern—cost its sponsor a modest $9. That same $9 would have bought only one one-thousandth of a second of prime time during the transmission of Super Bowl XV in January 1981.

In the future, promoters who have little or nothing to say about their products would have much less time in which not to say it. One famous commercial could be compressed to a single word, a voice-over announcer would be heard carefully enunciating "Parkay" during a program break.

*Reruns.* To encourage wholesomeness and to inspire love of country, various government agencies could sponsor modernized versions of old favorites. The Department of Defense, for instance, could score big with *Mr. Wizard, American*, featuring segments on everything from turning that backyard satellite dish into an enemy radar jammer, to beaming treasonous neighbors with low level radiation from Mom's microwave oven. NASA officials meanwhile might obtain network funding for another Viking mission, ostensibly as a talent search for their remake of *My Favorite Martian*.

And the National Science Foundation could strike a blow for scientific ethics with the ever-popular *Leave It to Beaver*. A typical episode: The Beaver hopes to land first place in the local science fair with his exhibit on cryogenics, but he lands in big trouble instead when Mrs. Cleaver discovers the neighbor's prize poodle in the deep-freeze next to the pork chops. The canine's failure to revive leads to an instructive ending.

"Gee, Beav," exclaims perceptive brother Wally, "that was a dumb ideal"

"Golly, Wally," replies a chagrined Beaver, "I guess you're right. I'll never use technology for my own selfish purposes again."

*Scott A. Piper is a freelance writer who lives in North Dakota and who admits to watching a little too much television.*

The all new 1983 Tercel 4WD Wagon 5 doors 4-wheel drive And startlingly unique in appearance Not bad for starters But the further you go, the better the story gets

Tercel switches from front-wheel drive to four-wheel drive "on command" with one simple shift Even while moving through snow, mud or worse*

Tercel's fuel efficient 1 5 liter SOHC engine delivers the best fuel economy of ANY 4-wheel drive 42 Estimated Highway MPG, (32) EPA Estimated MPG** Add that to the convenience of an extra large fuel tank, and you've got a cruising range of up to 554 miles.

Tercel's innovative 6-speed overdrive transmission makes icy roads, mud or the occasional iceberg no big challenge And independent front suspension makes the ride super smooth The traction, superbly surefooted

Inside Tercel gives you more room than any small 4WD Wagon Especially in the easy-access hatchback rear Sports seats wrapped in specially designed cloth, dual remote control mirrors, AM/FM/MPX 4-speaker stereo, and even an optional power sunroof make Tercel as much fun to sit in as to drive

OH WHAT A FEELING!
TOYOTA

The all new 1983 Tercel 4WD SR5 Wagon By the looks of it, it may be the year's hottest new car But in terms of function, it delivers the goods with a calculation that's icy cold

*For rough road use Installation of the optional Chassis Gravel Shields is recommended
**Remember Compare this estimated MPG to other "Estimated MPG" of other gasoline-powered cars with manual transmission You may get different mileage depending on how fast you drive, weather conditions and trip length Actual highway mileage will probably be less than the Highway estimate

BUCKLE UP—IT'S A GOOD FEELING

# NOW TOYOTA HAS A NEW FOUR-WHEEL DRIVE WAGON. BUT THAT'S JUST THE TIP OF THE ICEBERG.